CH2M HILL
One Dayton Centre
Suite 1100
One South Main Street
Dayton, OH 45402
Tel 937.228.3180
Fax 937.228.7572

February 20, 2007

Mr. Donald Heller
U.S.EPA Region 5
DW-8J
77 West Jackson Blvd.
Chicago, IL 60604-3507

Subject: Draft Corrective Measures Proposal, EMD Chemicals Inc. Cincinnati Facility, Revision 2

Dear Don:

On behalf of EMD Chemicals Inc. (EMD), CH2M HILL is submitting replacement pages that will constitute Revision 2 of the Draft Corrective Measures Proposal (CMP). The original Draft CMP was submitted to U.S.EPA on June 16, 2006, which fulfilled the requirement under Section V(D)(2) of the Voluntary Corrective Action Agreement, executed on September 23, 2004 by EMD and U.S.EPA, inclusive of the request to extend the CMP submittal deadline to June 30, 2006 (granted by U.S.EPA on December 8, 2005). As a response to USEPA comments on Revision 0 of the draft CMP, EMD submitted Revision 1 of the CMP on November 3, 2006. Following this submittal, U.S.EPA began to prepare the Statement of Basis (SOB) for corrective measures to be performed at the site.

During preparation of the SOB in January 2007, U.S.EPA requested the inclusion of a post-implementation monitoring plan for chemicals of concern (COCs) in addition to the hydraulic monitoring plan that was presented in the draft CMP. EMD concurred with the request and prepared a 5-year post implementation monitoring plan for COCs. The plan calls for an evaluation at the end of the 5 year period to assess if additional monitoring is necessary.

Two copies of the replacement pages are attached that include the text modifications for the addition of the post implementation COC monitoring plan to the draft CMP as follows:

- Revised Cover Page and Table of Contents (pages II - III)
- Section 6.4.2. COC Monitoring (page 6-8)

Please replace the corresponding pages in Revision 1 of the CMP (dated November 3, 2006) with these pages. All other pages included in Revision 1 of the draft CMP remain the same. EMD understands that this will be the final revision of the CMP and that U.S.EPA will be able to complete and issue a draft Statement of Basis for EMD's review.

Please call me at (937) 228-3180 ext. 233 if you have any further questions.

Sincerely,

CH2M HILL, Inc.

Mark Altic
Project Manager

CC: Joe Smindak – Ohio EPA, SWDO (1 copy)
Public Repository (via TPF) – Cincinnati Public Library, Norwood Branch (1 copy)
Paul Nelson – EMD Chemicals Inc. (1 copy)
Dan Weed – TPF (1 copy)

CH2M HILL
One Dayton Centre
Suite 1100
One South Main Street
Dayton, OH 45402
Tel 937.226.3180
Fax 937.228.7572

CH2MHILL

November 3, 2006

Mr. Donald Heller
U.S.EPA Region 5
DW-8J
77 West Jackson Blvd.
Chicago, IL 60604-3507

Subject: Draft Corrective Measures Proposal, EMD Chemicals Inc. Cincinnati Facility, Revision 1

Dear Don:

On behalf of EMD Chemicals Inc. (EMD), CH2M HILL is submitting Revision 1 of the Draft Corrective Measures Proposal (CMP). The original Draft CMP was submitted to U.S.EPA on June 16, 2006, which fulfilled the requirement under Section V(D)(2) of the Voluntary Corrective Action Agreement, executed on September 23, 2004 by EMD and U.S.EPA, inclusive of the request to extend the CMP submittal deadline to June 30, 2006 (granted by U.S.EPA on December 8, 2005).

After the original June 16 submittal, U.S.EPA requested additional information on the evaluation of remediation alternatives. EMD subsequently submitted to U.S.EPA a revised draft CMP on June 30 which included a new Section 5 – Evaluation of Alternatives.

Review comments were then received from U.S.EPA on July 6, July 14, and July 26 via telephone; and on August 24 via email. Responses to these comments were discussed and agreed to between Mark Altic (EMD's consultant project manager) and yourself. All review comments from these dates, along with the agreed-to corresponding responses from EMD, have been incorporated into a Response to Comments document, included as Appendix A of this revised Draft CMP.

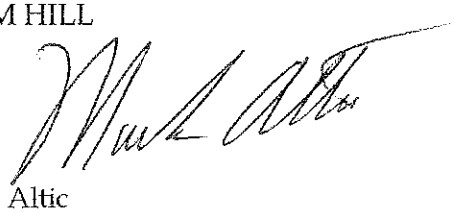
EMD submitted to U.S.EPA a revised Human Health Risk Assessment Addendum (HHRAA) for this site on October 11, 2006. Additional language was included in the Draft CMP to reflect the October 11th HHRAA (revised based on agreed-to response to comments from the U.S.EPA). The October 11th HHRAA was accepted by U.S.EPA with no additional comment on October 25, 2006.

The attached Revision 1 of the Draft CMP includes revised text and figures as described in the Response to Comments document and the additional text resulting from the updated HHRAA. This revised Draft CMP is a complete document with all attachments, and should replace any previous copies that you have in your possession. EMD understands that U.S.EPA will prepare issue a draft Statement of Basis for EMD's review, upon review and approval this Draft CMP.

Please call me at (937) 228-3180 ext. 233 if you have any further questions.

Sincerely,

CH2M HILL



Mark Altic
Project Manager

CC: Joe Smindak – Ohio EPA, SWDO
Public Repository (via TPF) – Cincinnati Public Library, Norwood Branch
Paul Nelson – EMD Chemicals Inc.
Dan Weed - TPF

MEMORANDUM

DATE: September 13, 2006

SUBJECT: U.S. EPA's Signature on Environmental Covenants in the State of Ohio

FROM: T. Leverett Nelson, Chief
Multi-Media Branch I
Office of Regional Counsel, Region 5

TO: ORC Section Chiefs

This memo is to let you know that Region 5 will use the attached Environmental Covenant for River Recycling, Inc. as a model for environmental covenants for sites located in the State of Ohio. The enclosed document was developed under Ohio's newly enacted Uniform Environmental Covenants Act. (Attachment 1).

The Ohio legislature passed and the Governor of Ohio signed into law a uniform law for the creation of environmental covenants in the State of Ohio. The Ohio UECA can be found in sections 5301.80-92 of the Ohio Revised Code, ORC §§ 5301.80-92. It provides for third-party enforcement of environmental covenants required as part of an environmental response project. A required element of an environmental covenant, however, is the signature of the "applicable agency" on the covenant. The signature of the applicable agency does not convey any property interests or obligations on the signing agency. There is no environmental covenant, however, without the signature of the applicable agency.

The Office or Regional Counsel has researched the legal issues related to signing of a state environmental covenant. The legal analysis is included. (Attachment 2) Both the legal analysis and the attached document are limited to those situations where the underlying authority is being exercised on consent, not unilaterally.

In summary, there are no legal restrictions on the Agency signing the environmental covenants. Furthermore, the Agency has the authority to sign such documents under section 3008(h), 7003, 3004(u) and (v) and 3005(c)(3) of RCRA. The Region 5 person responsible for signing an environmental covenant will depend on the authority relied upon for the particular site. The Branch Chief for the Waste Management Branch within the Waste, Pesticides and Toxics Division is responsible for signing Environmental Covenants which are pursuant to the authority contained within section 3004(u), (v) or 3005(c)(3) of RCRA. (See Region 5 Delegation 8-6; September 30, 2002 memo from Phyllis Reed, Acting Director WPTD re: Delegation of Signature authority; and August 23, 2002 memo from Robert Springer and David Ullrich re: Prior Review by Office of Regional Counsel of Documents Originating within the Waste Management Branch of the Waste, Pesticides and Toxics Division.). The Branch Chief of the Enforcement and Compliance Assurance Branch within the Waste, Pesticides and Toxics Division is responsible for signing Environmental Covenants which are pursuant to the authority

relied upon in sections 3008(h) or 7003 of RCRA. (See Region 5 Delegations 8-9-A, 8-22-C, and 8-32). In all other instances you should consult the Delegations to determine the appropriate signatory. Prior concurrence by the appropriate Section Chief within the Office of Regional Counsel is required for all Environmental Covenants.

If you should have any questions, you may contact Rich Clarizio at 312-886-0559.

cc: Eric Cohen
Richard Clarizio
Sherry Estes
Jan Carlson
K. C. Schefski, OSRE
Ann Pontius, OSRE

Authority of Administrator to Sign Ohio Environmental Covenants

I. ***Question:*** Does the Administrator[1] have authority to sign an environmental covenant

Draft Response to USEPA Comments on EMD Chemicals Inc Draft Corrective Measures Proposal

PREPARED FOR: Mr. Donald Heller, USEPA, Region 5

PREPARED BY: CH2M HILL on behalf of EMD Chemicals Inc.

DATE: August 9, 2006

These are the final USEPA comments on the EMD Chemicals Inc (EMD) Draft Corrective Measures Proposal (Draft CMP) received via telephone by Mark Altic, CH2M HILL Project Manager from Mr. Don Heller, USEPA, Region 5 Project Manager, on July 6, 2006 and on July 14, 2006. EMD's responses are included below each comment.

Comment 1: Revise Figure 3 to show the location of the former tank farm area. Emphasize in text that most of it lies over the West Ravine.

Response – The figure will be revised to show the location of the former tank farm area and a discussion added to the text. However, the majority of the former tank farm does not lie over the West Ravine, it is to the west. The proposed location of the trench is designed to capture downgradient migration from the former tank farm location.

Comment 2: USEPA would like a schematic showing former tank farm concentrations vs depth. Discuss treatment with in-situ approach.

Response – EMD believes the information requested is a bit too detailed for the scope of the CMP. EMD proposes to reference the report(s) where the information can be located in the CMP.
The approach to treatment with an in-situ remedy is discussed in brief in the current Draft CMP. The design details still need to be worked out. Since the tank basin remediation project is not a necessary component of the CMP and is additional work EMD elected to perform, EMD proposes to keep the discussion of the tank basin remediation as is. EMD will provide details of the tank basin remedial design to the USEPA when the plan has been further developed.

Comment 3: The USEPA wants more details on performance monitoring – specify in a table what wells are to be sampled and what frequency, and type and frequency of visual inspections for cover system.

Response – A table showing the following will be added to the Draft CMP:

- well to be monitored including frequency and type of monitoring; and,
- type and frequency of visual inspections to be performed on the remediation system and cover system.

Please note that the performance monitoring plan presented in Section 6.4.1 and Section 7.5 of the Draft CMP calls for monitoring of the potentiometric surface to determine if hydraulic containment is being achieved. If it is determined that hydraulic containment is not being attained, then chemical monitoring would be insti

Off-Site Soils, dated June 2006 for the EMD facility in Cincinnati, Ohio. Comment numbering reflects that of original comments. Only the responses which do not appear adequate or require further action are addressed. Prior to preparation of a final version of the documents, revisions requested in the following comments should be incorporated in the form of redline change pages. Only those pages requiring revision need be submitted.

Evaluation of the Response to U.S. EPA General Comment 1.

- EMD states that, "because of sampling variability, there is the possibility that concentrations of some VOCs may be slightly higher after resampling" which suggests that the current concentrations and risk to human health are not necessarily represented accurately. Provide a discussion regarding why current conditions and volatile organic compounds (VOCs) concentrations may be slightly higher after resampling and why this is not a risk assessment concern.
- EMD acknowledges that there are increasing concentrations of compounds that are likely due to degradation. EMD states, "This degradation trend is expected to continue without further mitigation except maintenance of the previously installed Sump-562 Interim Measure." Justification for this statement is not provided regardless of the fact that concentrations of compounds are increasing. Provide justification for the aforementioned statement and a discussion of why the increasing concentrations are not risk drivers under current conditions.
- The assessment of off-site construction workers exposed to the maximum concentrations detected in 2006 at the VE522/523 locations yielded results that were higher than risk reduction objectives. EMD believes that construction workers will not be exposed solely to the concentrations at the two sampling locations, but rather an average concentration from samples across the off-site area. Provide justification regarding why an average concentration is a better representation of the off-site area and why the VE522/523 location is not considered a hot spot. In addition, discuss if the VE522/523 location scenario will occur in other areas since EMD states that, "concentrations of some VOCs may be slightly higher after resampling."
- Under the described conditions, the utility worker scenario is more realistic than the overly conservative construction worker scenario. As such, provide an assessment of off-site utility workers exposed to the maximum concentrations detected in the 2006 VE522/523 locations.

Evaluation of the Response to U.S. EPA Comment 2.

- Add language to the 2006 HHRA Addendum Update that identifies what updated and/or changed risk assessment guidance has been used since the 1996 Remedial Investigation Report rather than using language such as "additional guidance."

Evaluation of the Response to U.S. EPA Comment 3.

- EMD analyzed the entire VOC target analyte list (TAL) suite to assess the potential for increased risk from other constituents on the TAL. However, no discussion of other constituents on the TAL has been provided. A discussion of other constituents on the TAL and the potential for increased risk should be included.

Evaluation of the Response to U.S. EPA Comment 6.

- An organic vapor analyzer field screening instrument was not used to determine the soil intervals selected for analysis in 2006. Discuss why the samples collected from an interval that yielded the highest concentration results in 1997 will represent the highest concentration results in 2006.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5

TELEPHONE MEMORANDUM

DATE: July 26, 2006 2:25 pm

FROM: Don Heller, CAS DAH

TO: Mark Altic, CH2MHill

RE: Additional issues raised on Corrective Measures Proposal for EMD Chemicals

I telephoned Mark, who has returned from his vacation. I asked if he has received the comments and concerns raised by U.S. EPA's contractor, TechLaw, regarding contamination at the foot of the West Ravine and CH2MHill's revised risk calculations for the compounds detected. Mark has received the comments and said that his team is working on a response.

I also mentioned the concerns raised by Joe Smindak (OEPA-SWDO), in particular the adequacy of the existing and future cover over the West Ravine, and Mr. Smindak's desire for additional treatment (i.e., air stripping) of the extracted ground water, prior to discharge to the POTW. I directed Mark to have EMD look into the ground water treatment issue, and to provide detail (design, construction QA/QC, inspection schedules) for the existing and future pavement which will cover the West Ravine. Mark agreed to provide this in the revised CMP.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5

TELEPHONE MEMORANDUM

DATE: July 26, 2006 2:25 pm

FROM: Don Heller, CAS DAH

TO: Mark Altic, CH2MHill

RE: Additional issues raised on Corrective Measures Proposal for EMD Chemicals

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CH2M HILL
One Dayton Centre
Suite 1100
One South Main Street
Dayton, OH 45402
Tel 937.228.3180
Fax 937.228.7572

June 15, 2006

Mr. Donald Heller
USEPA Region 5
DW-8J
77 West Jackson Blvd.
Chicago, IL 60604-3507

Subject: Draft Corrective Measures Proposal, EMD Chemicals Inc. Cincinnati Facility

Dear Don:

On behalf of EMD Chemicals Inc. (EMD), CH2M HILL is submitting the Draft Corrective Measures Proposal (CMP) and updates to finalize the following, previously submitted documents:

- Technical Memorandum - Update for Human Health Risk Assessment Addendum of Off-Site Soils for EMD Chemicals Inc., Cincinnati, Ohio Facility (including updates to the Human Health Risk Assessment Addendum); and,
- Final Conceptual Model of Current Conditions.

Submittal of the CMP fulfills the requirement under Section V(D)(2) of the Voluntary Corrective Action Agreement, executed on September 23, 2004 by EMD and USEPA, inclusive of the extension request for CMP submittal on June 30, 2006 (granted by USEPA on December 8, 2005).

Updates to previously submitted documents are intended to bring the documents up-to-date with the latest understanding of environmental conditions at the site and are the primary support documents for the CMP. Please see the *Instructions for Replacing Updated Pages* guide, attached to each package, to update each of the previously submitted documents.

Document update highlights are as follows:

Technical Memorandum - Update for Human Health Risk Assessment Addendum of Off-Site Soils

The January 2006 USEPA approved HHRA identified potential risks slightly above USEPA risk reduction goals for a construction worker exposure scenario in a small off-site area located at the mouth of the West Ravine. The Technical Memorandum, submitted as an amendment to the January 2006 HHRA, updates the Human Health Risk Assessment Addendum (HHRA) to include the off-site investigation performed in May 2006 to assess current conditions. Data generated from the investigation was incorporated into the risk model and risks were recalculated. The revised risk assessment concluded that there are no currently unacceptable off-site risks associated with construction worker exposure scenario. Since this was the only complete pathway identified in the January 2006 HHRA, there are no currently unacceptable off-site risks associated with COCs that have migrated from the EMD site.

Final Conceptual Model of Current Conditions

To finalize this document, EMD has included the following technical memorandum submitted to USEPA in December 2005.

Confirmation Sample Collection for Completion of CA750 Groundwater Environmental Indicators - EMD Chemicals Inc. Voluntary Corrective Action Agreement Submittal

This technical memorandum presents the results of confirmation grab groundwater sampling performed per the request of USEPA, Region 5 to verify migration of contaminated groundwater is under control.

In addition, portions of the CMCC have been updated to reflect the results of the confirmatory sampling and the updated risk assessment resulting from the off-site investigation performed in May 2006.

EMD would like to work with the USEPA to address any questions or concerns prior to receiving formal comments on the CMP. Following your review, please call me to discuss possible arrangements.

Please call me at (937) 228-3180 ext. 233 if you have any further questions.

Sincerely,

CH2M HILL

Mark Altic
Project Manager

CC: Joe Smindak – Ohio EPA, SWDO
Public Repository (via TPF) – Cincinnati Public Library, Norwood Branch
Paul Nelson – EMD Chemicals Inc.
Dan Weed - TPF

April 7, 2006

Mr. Donald Heller
USEPA Region 5
DW-8J
77 West Jackson Blvd.
Chicago, IL 60604-3507

Subject: EMD Chemicals Inc Norwood Facility Conceptual Agreement

Dear Don:

EMD Chemicals Inc (EMD), is submitting the attached document entitled Conceptual Agreement for Corrective Measures Plan, EMD Chemicals Inc Cincinnati Facility that presents a summary of our meeting held on March 10, 2006 and a record of the conceptual agreement between USEPA, Region 5 and EMD on proceeding with corrective measures at the subject Facility. EMD respectfully requests that you review the document and respond indicating your concurrence with the content of the document.

Please call me or Paul Nelson at (513) 631-0445 if you have any further questions.

Sincerely,

Mike Mulligan
Vice President of Operations

CC: Gerry Phillips - USEPA
Paul Nelson – EMD
Lauri Gortin – CH2M HILL
Mark Altic – CH2M HILL
Dan Weed – The Payne Firm

Conceptual Agreement for Corrective Measures Plan

EMD Chemicals Inc Cincinnati Facility

(Summary of the March 10, 2006 USEPA, Region 5/EMD Meeting)

USEPA, Region 5 and EMD Chemicals Inc (EMD) met on March 10, 2006 to discuss the status of EMD's Voluntary Corrective Action Agreement. During this meeting, EMD and USEPA agreed in concept to the approach to corrective measures outlined below for the subject facility. Based on this conceptual agreement, EMD is proceeding with development of their Final Corrective Measures Proposal (FCMP) and will be submitting it to USEPA on or before June 30, 2006.

The following personnel were in attendance:

Mr. Don Heller (USEPA, Region 5 Project Manager)
Mr. Gerry Phillips (USEPA, Region 5, Corrective Action Manager)
Mr. Mike Mulligan (EMD Vice President of Operations and Facility Manager)
Mr. Paul Nelson (EMD Engineer and Project Manager)
Ms. Lauri Gorton (CH2M HILL Senior Consultant/Regulatory Specialist)
Mr. Mark Altic (CH2M HILL Project Manager)

Current Conditions Overview

Risk Assessment

- Human Health Risk Assessment complete
  - On site risks identified and to be managed through corrective measures.
  - Off-site risks limited to construction workers direct contact for a localized area of soils (<1% at the base of the West Ravine – carbon tetrachloride slightly above USEPA protectiveness levels in soils 8-10 feet below ground level).
- Site contamination does not pose a significant risk to any on-site ecology and no complete or significant ecological receptor exposure pathways were observed off-site in relevant areas.

Environmental Indicators (EI)

- Human Exposure Under Control EI Determination Completed ("YE") on April 20, 2002.
- Groundwater EI Determination Complete with a "YE" determination – Migration of contaminated groundwater is under control.
  - Not exceeding risk-based levels in off-site groundwater (not a potable source of drinking water – low yield and restricted use due to current and foreseeable land use and current governmental institutional controls restricting use).

- No unacceptable surface water impacts are occurring as demonstrated through quarterly monitoring of surface water.

Corrective Measures Approach

Proposed Corrective Measures

- Incorporation of selected Interim Measures into final remedy.
  - French Drain System (capturing groundwater containing COCs migrating to the east)
  - P6a Recovery Well (a currently non-operating backup recovery system for the French Drain)
  - Disposal of collected water by the interim measures will be employed – process through a pretreatment system consisting of pH neutralization and then discharge to the POTW under a permit (EMD's current permit will be modified to include the new discharge).
- Consolidation of localized area of offsite waste and contaminated soil in onsite containment area. Implementation will require temporary construction easement from Ohio Department of Transportation (ODOT) and Norfolk Southern Railroad (NS) to provide necessary access.
- Cover and containment of on-site waste and contaminated groundwater through cover and hydraulic capture systems installed entirely on site is an acceptable approach.
- Institutional controls to manage potential onsite exposures
  - On-site - EMD will evaluate the options and present to USEPA the most viable options for on-site institutional controls. ICs will likely be some combination of equitable servitude, deed restrictions, and EMD site safety program protocols and procedures.
  - Off-Site – Fencing may be used to control access if soils containing carbon tetrachloride in concentrations that exceed USEPA protectiveness levels are not able to be removed due to physical constraints on excavation. Implementation of access control subject to agreement from ODOT. Existing institutional controls (no unapproved 3rd party access to subsurface on ODOT/NS property and water well installation restrictions) will be incorporated for off-site control.
- Natural attenuation will continue to reduce concentrations of COC's in groundwater over time.
- EMD is currently evaluating remedial options for source reduction in the old Tank Farm area located west of the West Ravine.

On-Site Performance Standards

- Effectiveness of containment (waste and contaminated groundwater) will be demonstrated through the following observations:
  - Surface conditions indicative of subsidence
  - Concentration levels of contaminants in groundwater remain constant
- Engineering controls:

  - Site cover integrity demonstrated through periodic monitoring for cracks (structures) or erosion (soil cover)
  - Access controls demonstrated through periodic inspection of fencing
- Demonstration that appropriate institutional controls are in place and effective:
  - Deed restriction to industrial land use is filed.
  - Site operational practices and controls implemented to protect workers.

Off-Site Performance Standards

- Visible and accessible wastes (consisting of concrete demolition debris, broken or whole bottles containing off-spec chemicals) will be removed.
- Off-site soils identified as being impacted through visual or screening level observations (eg. photo ionization detector) will be removed to the extent practical during construction. Excavations will be limited to physical restraints (road, railroad bridge, etc.). Confirmatory soil sampling will not be necessary or conducted.
- Cleanup criteria for off-site groundwater will be risk-based levels for COCs associated with EMD facility.
  - Criteria to be calculated based on appropriate and currently identified exposure scenarios for current and reasonably anticipated future land use (a construction worker entering an excavation in the affected area of the transportation corridor).
  - MCLs are not applicable because perched groundwater is not a drinking water source and therefore ingestion is not a relevant exposure pathway.
- Point of compliance is property boundary.

Mechanism for Long-Term Operation, Maintenance and Monitoring of Corrective Measures

- USEPA will issue EMD a Corrective Measures Implementation (CMI) order to establish the conditions for long-term operation, maintenance and monitoring of Corrective Measures.
- USEPA has streamlined CMI orders and is willing to negotiate the terms and conditions in parallel with review and approval of EMD's FCMP.

Operation, Maintenance & Monitoring

- Standards will be established in the CMP to determine remedy effectiveness and completion through monitoring of groundwater.
- A plan for assuring that institutional controls remain effective and in-force will be established in the CMP.

Long-Term Care

- CMP will include remedial goals and end points for monitoring/operation of CMs based on completion/demonstration of meeting Performance Standards.

- Financial Assurance not currently required by Region 5 under the VCAA for remedy implementation but will be required as part of the CMI order.

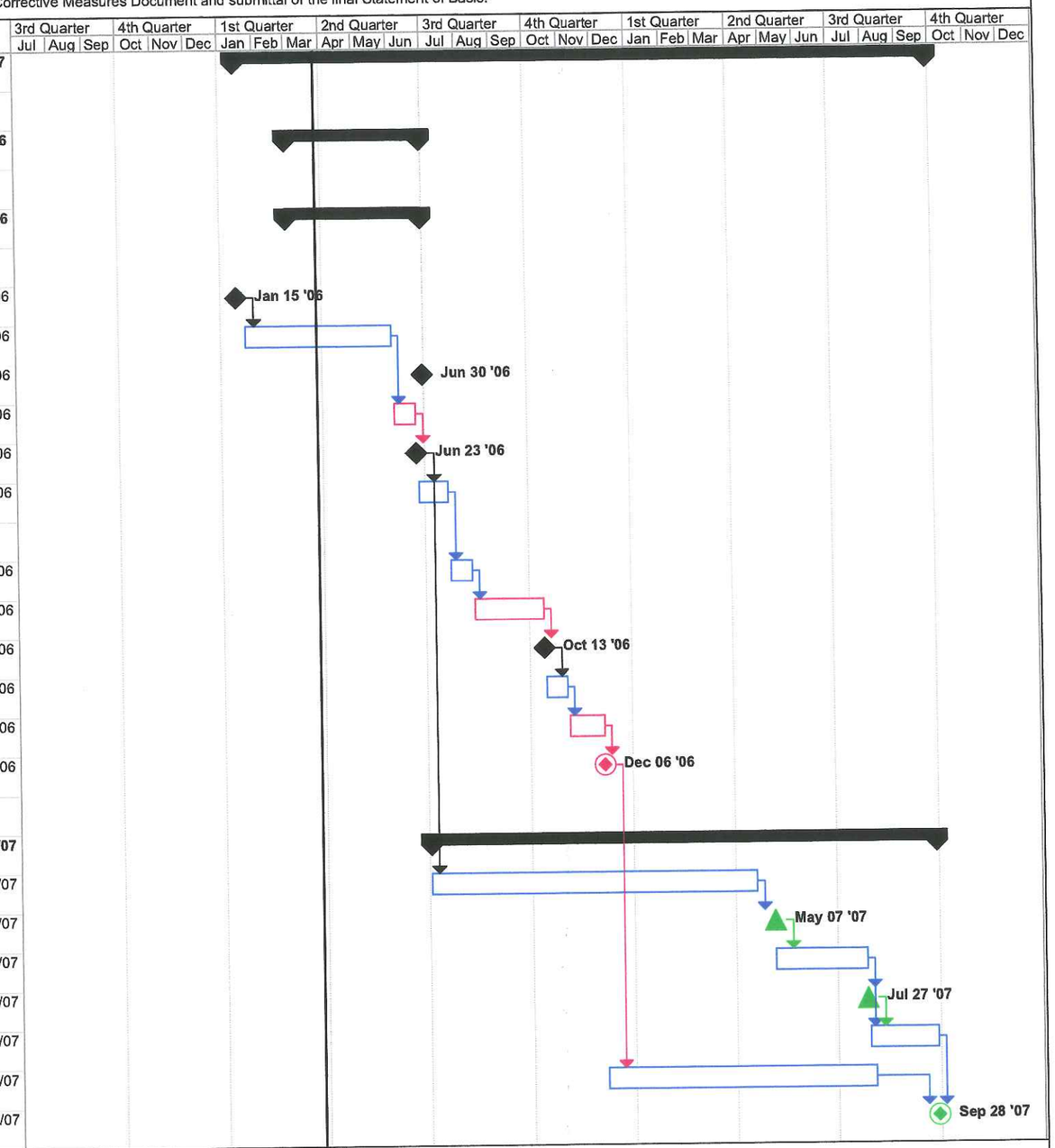
Process to Complete FCMP/Construct Remedy

- The FCMP will address all elements of USEPA's Statement of Basis (SOB).
- The FCMP will be a performance-based proposal that will identify the remedy elements and the performance standards as agreed to by USEPA and EMD in this document. EMD can use any means necessary that are consistent with elements to meet the agreed upon performance standards.
- Standard schedule from receipt of CMP by USEPA to submittal of SOB by USEPA is 4 to 6 months. Quickest schedule for USEPA to turn around necessary documentation is 2 -3 months but this is unlikely. EMD can assist USEPA with expediting the schedule through submittal of a CMP that closely follows the format to be used by USEPA to create the SOB.
- EMD can self perform and self certify corrective measures based upon the documentation presented herein. However, implementation of CMs will be at risk until the SOB has been prepared and accepted by the public.
- Attached schedule – based upon reasonable timeframe for execution of project by all parties as discussed.

Schedule for Completion of Corrective Measures, EMD Chemicals Inc Cincinnati Facility

Note: This schedule is based upon EMD waiting for full USEPA approval of the Corrective Measures Document and submittal of the final Statement of Basis.

ID	Task Name	Duration	Start	Finish
1	**Proposed Schedule for Corrective Measures Completion**	**445 days?**	**Sun 01/15/06**	**Fri 09/28/07**
2				
3	**Obtain ODOT Permit for Access**	**87 days?**	**Wed 03/01/06**	**Thu 06/29/06**
7				
8	**Obtain NS Railroad Permit for Access**	**87 days?**	**Wed 03/01/06**	**Thu 06/29/06**
13				
14	Begin Preparation and Submittal of Final Corrective Measures Proposal	0 days	Sun 01/15/06	Sun 01/15/06
15	Preparation and Submittal of Final CMP	95 days?	Mon 01/23/06	Fri 06/02/06
16	Current VCAA Agreed Submittal Date	0 days	Fri 06/30/06	Fri 06/30/06
17	USEPA Review of draft CMP	15 days?	Mon 06/05/06	Fri 06/23/06
18	Receive comments on final CMP from USEPA	0 days	Fri 06/23/06	Fri 06/23/06
19	Revise and Submit final CMP to USEPA	20 days?	Mon 06/26/06	Fri 07/21/06
20				
21	USEPA Prepares/Submits Statement of Basis	15 days	Mon 07/24/06	Fri 08/11/06
22	Completion of USEPA Public Meeting/Public Comment and Response	45 days?	Mon 08/14/06	Fri 10/13/06
23	Receive Public Comments	0 days	Fri 10/13/06	Fri 10/13/06
24	Incorporation of comments/submittal of final Corrective Measures Plan	15 days	Mon 10/16/06	Fri 11/03/06
25	USEPA final review and approval of Corrective Measures Plan	23 days?	Mon 11/06/06	Wed 12/06/06
26	All approvals in place for Remedy Construction	0 days	Wed 12/06/06	Wed 12/06/06
27				
28	**Complete Design/Construct/Operate Corrective Measures**	**325 days?**	**Mon 07/03/06**	**Fri 09/28/07**
29	Complete Design & Award Contract	210 days	Mon 07/03/06	Fri 04/20/07
30	Begin Construction of Corrective Measures	0 days	Mon 05/07/07	Mon 05/07/07
31	Implement Construction of Corrective Measures	60 days	Mon 05/07/07	Fri 07/27/07
32	Complete construction of Corrective Measures/Begin O&M	0 days	Fri 07/27/07	Fri 07/27/07
33	Prepare/Submit CM Construction Completion Report	45 days?	Mon 07/30/07	Fri 09/28/07
34	Deed Restrictions and Equitable Servitude Finalized/Final Decision Letter	172 days	Thu 12/07/06	Fri 08/03/07
35	CM Remedy Complete/Operate and Monitor Remedy	0 days	Fri 09/28/07	Fri 09/28/07



Project: EPA OnSite Projected EMD Project Schedule
Date: Mon 03/27/06
Red Task Bar - Dependant on External Response
Blue Task Bar - EMD Project Team Dependant

Task | Split | Progress | Milestone | Summary | Project Summary | External Tasks | External Milestone | Deadline

Donald Heller/R5/USEPA/US
04/05/2006 04:00 PM

To "Altic, Mark/DAY" <Mark.Altic@ch2m.com>
cc
bcc
Subject Re: EMD Conceptual Agreement

Mark,

no comments from either of us.

Don
"Altic, Mark/DAY" <Mark.Altic@ch2m.com>

"Altic, Mark/DAY"
<Mark.Altic@ch2m.com>
03/31/2006 08:50 AM

To

Subject EMD Conceptual Agreement

Don:

We would like you and Gerry to review the attached Draft Conceptual Agreement and schedule for CMP implementation at EMD so we can incorporate any comments you both may have before we send it to you formally and request a formal response. Please review, forward to Gerry to gather his input, and then return to me.

Please call me if there are any questions.

Thanks,
Mark

Draft Final Conceptual Agreement for Corrective Measures Plan.doc

OnSite Projected EMD Project Schedule Post EPA Meeting.pdf

DISCUSSION OF REMEDIAL OPTIONS
March 10, 2006

EMD CHEMICALS, INC.

OHD 086 438 538

NAME	AFFILIATION	TELEPHONE
DON HELLER	U.S. EPA, REGION 5	(312) 353-1248
LAURI GORTON	CH2M HILL	(414) 732-4514
Paul Nelson	EMD Chemicals	(513) 587-5219
MIKE MULLIGAN	EMD CHEMICALS	(513) 631-0445
Mark Altic	CH2MHILL	(937) 228 3180
GERALD PHILLIPS	U.S EPA	(312) 886 0977

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rock committed $30 mil to facility renovation
EMD will implement ICs

Final remedy will incorporate French drain, well P6, fencing
" " " replace Sump S62, current stormwater mgmt.

To excavate such a deep trench will involve both heavy equipment and linked borings.
They anticipate very low flow gw conditions.

The buildings that will be demolished are slabs - no soil issues.

ICs will include deed restrictions and gw use restrictions.
Will there be a long-term order? Need something that would run w/ the land. Need long-term care requirements for engineered controls that would apply to any future property owners. Need long-term $ assurance, for maintenance of eng. controls.

"Small area of contaminated soil above excess risk standards" at base of west Ravine will have to be addressed, because of assumed future unrestricted access. How to do long-term maintenance of the fence if not on their property? Do some soil borings to first define how large a mass of contaminated soil there is?

Need explained that there are State and local prohibitions on installing potable water wells in the west Ravine area.

ray - is it ok to send extracted gw to POTW? Mike M. - yes, already being done.

* Gary - need validation plan to ascertain that ICs and Eng. controls have been successful. EMD agreed.

EMD wants some sort of plan for scaling back and terminating portions of OTM.

OTM plan would be submitted at some time as const. completion report. We can execute streamlined CMP order.

* We can get copies of the CMP packages (George Hampar) to Mark. * Also, copies of SOBs.

* We will give OEM a copy of draft SOB for comment.
- AND meet w/ OEM (at EMD or SWDO)

For public comment period, etc., 4-6 months for review & approval of CMPs. - Gary

Letter to summarize meeting, proposed implementation schedule, and * agreement in concept.

Gary - EMD should think about $ assurance mechanism, in case it will be required by OEM.

Gary - could begin negotiating CMP order right now.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGIONS 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF:

DW-8J

CERTIFIED MAIL: 7001 0320 0006 0202 5868
RETURN RECEIPT REQUESTED

December 8, 2005

Mr. Michael C. Mulligan
Vice President, Operations
EMD Chemicals, Inc.
2909 Highland Avenue
Cincinnati, Ohio 45212

RE: Request for Time Extension for Submission of Corrective Measures Proposal
EMD Chemicals, Inc. OHD 086 438 538

Dear Mr. Mulligan:

We have received your December 7, 2005, request for extension of the due date for submission of the Corrective Measures Proposal (CMP) for your facility, which is described in the September 23, 2004 RCRA voluntary corrective action agreement. This request was prepared by CH2M Hill, and proposes submission of the CMP by June 30, 2006.

The request states that both the Ohio Department of Transportation (ODOT) and the Norfolk Southern (NS) Railroad are contemplating whether to allow construction of EMD's proposed leachate/ground water collection trench on their properties. These continuing negotiations have made it necessary for an extension of the due date for submission of the CMP to U.S. EPA.

Based upon the information which you have provided, your request for the June 30, 2006, due date is hereby granted.

Be advised that U.S. EPA will abide by the decisions of both ODOT and the NS Railroad as to whether or not any portion of the final corrective measures may be constructed on their properties.

Please contact me at (312) 353-1248 if you have questions.

Sincerely,

Donald A. Heller

Donald A. Heller, Environmental Scientist
Corrective Action Section
Waste Management Branch

cc: Joe Smindak, OEPA – SWDO
Mark Altic, CH2M Hill

614 466 - 7942

MEETING SUMMARY CH2MHILL

Second ODOT/EMD Discussion of Corrective Measures in ODOT/Norfolk Southern R/W
August 25, 2005

Attendees

Julie Denniss, Environmental Services (**ODOT**)
Cash Misel, Assistant Deputy Director (ODOT)
David Riley, Central Office. Hyd. (ODOT)
Jherri Eddlerlute, Dist. 8 (ODOT)
Michael Flynn, Deputy Director District 8 (ODOT)
Tim Hill, Administrator Office of Env. Services (ODOT)
Andrea Stevenson, Office of Env. Services (ODOT)
Kirk Beach, Office of Geotech Eng. (ODOT)
Tim Killeen, Office of Env. Services (ODOT)
Mark Clark, Planning District 8 (ODOT)
Chris Hilbert, District 8 Permits (ODOT)
Greg Patton, Planning District 8 (ODOT)
Gene Geiger, Administrator, Office of Geotech Eng (ODOT)
David Riley, Central Office. Hyd. (ODOT)
EMD Chemicals Inc., Cincinnati, Ohio
USEPA ID No. OHD 086 438 538

Mike Mulligan (**EMD**)
Paul Nelson (EMD)
Kathy Arnett (CH2M HILL)
Mark Altic (CH2M HILL)
Doug Briggs (CH2M HILL)
David Dickey (CH2M HILL)
Dan Weed (The Payne Firm)
Don Heller (USEPA R5) – **via conference call**
Kevin Hodnett, Office of Env. Services (ODOT)
Dirk Gross, Administrator, Office of Roadway Services (ODOT)
Jherri Eddlerlute, Dist. 8 (ODOT)

COPIES:
Paul Nelson, EMD
Dan Weed, TPF
Greg Patton, ODOT
Julie Denniss, ODOT
Don Heller, USEPA

FROM: David Dickey
Assistant Project Manager

DATE: August 26, 2005

CH2M HILL PROJECT NUMBER: 181174

Meeting Purpose

Update Ohio Department of Transportation on EMD Chemicals Inc.'s (EMD) approach to corrective measures.

In summary, EMD presented an update to the site status since the last meeting with ODOT in 1994, discussed the proposed trench design, and addressed known ODOT concerns. The floor was opened to discussion after which the following items were identified for further action.

EMD:
Examine strategies to safely remove wastes from ODOT property.
Explore designs of the groundwater collection trench to minimize potential impact to highway construction options.
Examine potential geometries of highway expansion and provide those to ODOT for discussion.
Examine options for placing the groundwater collection trench on EMD instead of ODOT property.
Provide additional information regarding ODOT property boundaries and groundwater potentiometric elevations.

ODOT:
Provide highway information to EMD for highway geometry examination.
Update Federal highway personnel on the site status and proposed trench design.

A copy of the meeting agenda is attached.

Presentation
Mark Altic and Kathy Arnett presented a current status report of the extent of off-site impacted soil and groundwater with a proposed approach to remedial action.

Discussion/Concerns

During the presentation:
1) ODOT wanted clarification regarding the determination that groundwater migration is under control. Mr. Altic said that the modeled and sampled groundwater plumes are not expanding and that there are no currently known sources of groundwater contamination or areas of release. Continued groundwater monitoring has shown contaminant concentrations to be stable or decreasing.

2) ODOT asked if the wastes monitored in the groundwater are the same as those disposed in the West Ravine. This was confirmed by EMD.

3) The boundaries of ODOT, Norfolk Southern, and EMD property and right-of-way was presented on an aerial photograph and discussed at length. Waste materials exist on both ODOT and Norfolk Southern property. The amount of buried glass containers possibly containing off-spec chemicals increase significantly in the West Ravine fill as one proceeds from the from ODOT/NS properties to EMD property up the West Ravine.

4) ODOT would like additional information on the north to south cross-section running through the West Ravine ("West Ravine-Duck Creek Cross Section" of the Conceptual Model of Current Conditions) regarding location of ODOT property boundaries (Action Item 1).

5) In answer to ODOT questions, EMD stated that the effluent from the French Drain, recovery well P6, and West Ravine sump are routed to an on-site pre-treatment groundwater system then discharged under permit to the City of Cincinnati Metropolitan Sewer District (MSD).

6) The "bulls-eye" of the mounded groundwater illustrated by a potentiometric surface map is currently under investigation to determine if it is caused by a leaking fire water system that is undergoing repair. ODOT requested a recent potentiometric map which will be provided by EMD (Action Item 2).

7) Groundwater was stated to ultimately discharge either to the West Ravine sump, the French Drain, or if off-site, to the 96-inch storm sewer backfill or to the Duck Creek backfill. Following CM implementation, the proposed trench is expected to capture all impacted groundwater that migrates off of EMD property to the southeast towards Duck Creek while natural attenuation reduces the remaining off-site impacts over time.

8) There is an off-site area (near the highway) of soil contaminated with carbon tetrachloride, approximately 25 feet wide, at approximately 8 to 10 feet below ground surface that slightly exceeds USEPA standards for a construction worker if they are exposed to those soils over a time-weighted average of 8 hours per day for 125 days for one year. However, under the expected exposure scenario, the concentration is not expected to exceed permissible OSHA standards (EMD referred to the Human Health Risk Assessment). Installation of the proposed trench would excavate a portion of this contaminated soil as well as enhance natural attenuation near the trench.

9) As part of Corrective Measures, monitoring of groundwater will continue to assure the corrective measures implemented are working as intended.

10) The Corrective Measures proposed for the West Ravine were presented and include reconfiguration of the slope of the ravine face, installation of an infiltration mitigating cap, improvements of the drainage system to redirect stormwater away from the West Ravine fill, and improvement of the system to collect groundwater that will be discharged though a permitted groundwater treatment system to a municipal storm sewer. General construction details of the proposed groundwater collection trench were described to the meeting attendees.

11) Based on the groundwater modeling results, the proposed 15 to 20 foot deep and 175 foot long trench will collect approximately 100 to 200 gallons of impacted groundwater per day. This low volume is indicative of the low hydraulic conductivity of the impacted saturated zone targeted by the trench .

12) Construction of the trench would require installation of sheet piling to shore the trench sides during construction and "Jersey Barriers" to protect workers from traffic. Traffic plans will be submitted to ODOT for approval as part of the permitting package for Corrective Measures construction. Every attempt will be made to avoid impacts to traffic on SR 562.

13) The potential impact to future ODOT highway expansion construction was discussed. ODOT does not expect to begin design of highway expansion work in the area for at least 10 years.

14) Removal of all West Ravine waste (including that on EMD property) could result in an increased public health hazard due to vapor and liquid releases from buried glass containers or an extended shut down of EMD (facility operations require use of the land over the West Ravine). EMD stated that on balance, containment of wastes in place on EMD property is the best strategy for the protection of human health and the environment than removal of all wastes.

15) The potential benefits of a slurry wall to contain the flow of contaminated groundwater were discussed. However, a slurry wall without proper hydraulic pressure control would likely result in contaminated groundwater exploiting an undesirable path of least resistance. Hydraulic fracturing to increase the recovery efficiency of onsite groundwater recovery wells (and thus maintain the desired hydraulic pressure) was proven an ineffective solution as previous field tests indicated that fractures propagated vertically and not horizontally.

16) An alternative to the slurry wall, an onsite trench for groundwater capture, was discussed. This approach was found to be a technically and financially infeasible action. Installing a trench on the EMD property would require excavating to a depth of up to 60 feet to intercept the groundwater flow and could potentially cause the release of vapors and liquids from buried waste containers. Instead, the proposed off-site trench location is technically sound because it intercepts the groundwater containing COCs and would not disturb or break buried waste containers.

17) ODOT stated that it would be desirable to assess if corrective measures could be constructed entirely on EMD property via excavation of a portion of the engineered slope on ODOT property back to EMD property to allow for trench construction at the same elevation as proposed on the ODOT property. EMD noted as an initial response to this concern that this course of action may well result in a shut down of EMD operations for several months, temporary shut-down of the highway during implementation, and a potential public safety risk from

slope failure and vapor releases. EMD agreed to assess the feasibility of excavating the ODOT property hillside to allow installation of the trench on EMD property (Action Item 4).

18) ODOT prefers the removal of all solid wastes from its property and the installation of a groundwater collection system be completed as soon as possible. However, ODOT also recognized that no plans, schedules, or details exist as to any potential future highway construction (minimum 10 years out until any construction would occur). ODOT understands that EMD requires some level of detail regarding anticipated future interchange reconfiguration design in order to effectively evaluate and incorporate into the current containment system design (trench/cover system) the necessary features to be compatable for installation on ODOT property (Action Item 6a). EMD agreed to retain CH2M HILL's highway transportation design personnel to assess possible interchange configurations based upon ODOT's anticipated future requirements (Action Item 6b).

19) Mr. Cash Misel, Assistant Deputy Director of ODOT, stated that if all wastes were removed from ODOT property, then installation of the trench on ODOT property without a massive excavation of the hillside should not be an issue and that ODOT can work together with EMD to an agreeable solution. Mr. Misel asked ODOT and EMD personnel to work together to reduce uncertainties in ODOT highway construction options and for EMD to consider design of the trench in such a manner as to maximize ODOT's options in future highway construction. Finally, Mr. Misel requested EMD examine removal of wastes from ODOT property (Action Item 10).

20) ODOT stated its previous action item to submit a letter to USEPA listing its concerns was addressed in this meeting and reflected in these meeting notes.

confirm w/ Julie Dennis

ODOT Questions:

- The backfill solids (sand, gravel, other unconsolidated material) of the Duck Creek box culvert were not sampled. EMD explained that the contaminants of concern primarily occur in groundwater. Therefore, the impact is to saturated samples rather than vadose zone soils above the saturated zone
- ODOT asked if concentrations of constituents of concern are discharging to the surface waters in excess of USEPA levels. During the completion of the Groundwater EI, EMD demonstrated that concentrations of constituents of concern for surface waters do not exceed USEPA regulatory levels as monitored in the Duck Creek outfall..
- ODOT inquired if the groundwater plume was expanding. EMD stated that groundwater modeling, verified with empirical data, demonstrated that concentrations of the constituents of concern in groundwater are stable or declining. Additionally, the extent of the dissolved contaminant plume is well defined and contained via interception of the plume by the Duck Creek and 96-inch storm sewer backfill where it is subsequently diluted to either non-detect or concentrations approaching Region 9 Preliminary Remediation Goals for groundwater by additional fresh water influx to these features.. Monitoring of groundwater and the surface water is expected to continue under the Corrective Measures. — still want confirmatory samples of Duck Creek.
- ODOT asked about the possibility of a future release within the West Ravine from as yet unbroken chemical bottles. EMD stated that issue is one of the main reasons behind the proposed corrective measures including installation of the groundwater collection trench down gradient of wastes managed in place. Also that there has been no evidence of "slugs" of contamination from the 16-inch stormwater line located within the West Ravine from which groundwater samples have been collected for approximately 20 years
- The length of time necessary for the trench to be in place was discussed. EMD noted the time for the ODOT impacted groundwater to reach USEPA standards is unknown but that it will likely take years to decades. However, once the Corrective Measures are in place and trends are established from continued monitoring, a more precise estimate of time and possibly the option to replace the trench and sump with controls having a smaller areal footprint.
- ODOT requested clarification on the location of EMD's point of compliance. ODOT requested clarification on the location of EMD's point of compliance. EMD indicated that the point of compliance has not been established . It will be determined at a later stage in the project, likely as part of the final remedy selection. EMD went on to add that it is anticipated that the extent of the offsite plume will be taken into consideration when establishing a point of compliance.

- Concentrations of contaminants that may be encountered during highway construction and maintenance. EMD's information indicates that concentrations above USEPA but below OSHA calculated risk standards are encountered solely below 8 feet below ground surface. EMD recommends ODOT refer to the previously provided Conceptual Model of Current Conditions for additional information regarding construction worker and maintenance worker scenarios.
- That trench installation on property for which ODOT has an easement from Norfolk Southern will require NS's review and approval. EMD noted that a meeting with NS is planned in September 2005. EMD will confirm to ODOT that access and agreement for corrective measures implementation on NS property is being addressed through review and authorization by NS (Action Item 3).
- ODOT noted deed restrictions on their land may be necessary to protect the proposed trench and those Corrective Measure portions that are on their land (i.e. reconfigured slope) when ODOT considers highway construction and drainage maintenance (culverts and piping) in the area. ODOT would rather the trench and sump be placed on the top of the West Ravine on EMD property to prevent the need for deed restrictions. Safety concerns discussed in the following bullet exist regarding removal of wastes required by an onsite installation of a trench. EMD said it would assess feasibility of this installation on EMD property (Action Item 4) and will work with ODOT regarding potential deed restrictions.
- Waste on ODOT property. While there is approximately 300 cubic yards of waste on ODOT property, there is an estimated 40,000 to 45,000 cubic yards of waste (in-place volume estimate) on EMD property. EMD has assessed the technical aspects of removing all wastes from EMD property and found that the volume of wastes involved, the depth of excavation (up to 25 feet) required, the potential for severe public health and safety issues (i.e.: releases of uncontrollable vapors, and hazardous reactions, fires, or explosions during excavation) despite engineered precautions does not justify removing the wastes from EMD property. Despite many of these same hazards occurring during removal of wastes from ODOT property, the scale of removal, and thus hazard, is anticipated to be smaller and safe removal might be possible. EMD will assess the feasibility of removing wastes from ODOT property (Action Item 10).
- ODOT inquired about a "finger" of contamination to the west of the West Ravine. In the meeting, Mr. Altic said that he believed (based on memory) that the contaminant was primarily benzene, that its migration was under control (based on further downgradient monitoring data), did not extend beneath the highway, did not pose a risk to human health and the environment, and would likely biodegrade relatively quickly, therefore not needing additional corrective measures. A later review of the data revealed that the "finger" was the result of a soil sample collected from 8 to 12 feet below ground level (boring VE-517) that contained low concentrations of acetone, methylene chloride, and toluene that were detected below the laboratory quantification limits.
- Seeps and outfalls from the West Ravine 16-inch drainage culvert potentially impacted by contaminated groundwater. EMD stated these would be captured by the proposed trench and sump.
- ODOT asked how ecological habitats would be impacted (i.e. Indiana Bat) during construction. EMD responded that habitats potentially impacted by construction activites would be evaluated as part of the corrective measures process.
- The distance of the proposed trench and sump from the existing highway. EMD will more clearly describe those distances (Action Item 5).
- The size of the glass containers in the West Ravine was noted to be smaller than 55-gallon drums and are thought to be glass jars with phenolic lids similar in size to "Mason jars". Breakage of these containers is only likely if the area is physically disturbed by excavation equipment.
- ODOT acquiring responsibility for the waste if EMD should transfer ownership or abandon the property. EMD is willing to work with ODOT to resolve that concern within the Corrective Measures.
- Trench designs limiting future highway expansion or re-construction option. EMD said the trench can be designed to accommodate the most likely options and that it would assist ODOT in determining the most likely highway alignments (Action Item 6).
- Slope failure (Action Item 7).

EMD concerns:

- Lack of clarification of permitting and construction requirements allowing EMD to proceed with meeting its voluntary corrective action deadlines. (Action Item 8).
- Federal highway agency has not yet involved itself in the decision making process. ODOT had invited them to the meeting (Action Item 9).
- Clear guidance from ODOT on potential highway scenarios allowing EMD to design Corrective Measures that protect human health and the environment that are effective and constructible (Action Item 6).
- Due to the large amount of containers on EMD property, and a lesser amount on ODOT and Norfolk Southern property, EMD is concerned that if the unbroken chemical containers are disturbed, there may be a release of chemical vapors causing emergency conditions affecting residences, businesses, the highway, and the railroad (Action Items 4 & 10).

Action Items

1) EMD Action Item
Provide a figure to ODOT indicating their property on a cross-section diagram through the West Ravine.

2) EMD Action Item
Provide ODOT with a recent figure indicating groundwater potentiometric elevations.

3) EMD Action Item
Discuss with Norfolk Southern if they have expansion plans.

4) EMD Action Item
Conduct feasibility study of removing ODOT overburden (the hillside slope south of EMD) and wastes from EMD's property in the West Ravine to the extent necessary to permit the installation of a trench/containment system entirely on EMD property.

↳ will ODOT engineers review this ?

5) EMD Action Item
Provide ODOT with a scaled figure indicating the distance of the proposed trench and sump from the existing highway structures.

6a) ODOT Action Item
ODOT is to provide EMD a framework of the specifications for evaluating the interchange with respect to environmental and Right-of-Way concerns. Mr. Cash Misel of ODOT requested his personnel provide this to EMD within three weeks.

6b) ODOT action Item
ODOT is to work with Doug Briggs of CH2M HILL in finding appropriate overhead aerial photographs. ODOT is to provide Mr. Briggs with highway model information to allow CH2M HILL engineers to assess potential highway construction scenarios.

6c) EMD Action Item
CH2M HILL will evaluate the potential interchange design feasible alternatives for EMD to submit to ODOT for consideration.

6d) EMD Action Item
CH2M HILL engineers will design the trench to minimize potential impact to future highway construction plans. EMD will provide those trench construction details to ODOT for consideration.

7) EMD Action Item
EMD will assess the potential for slope failure in the West Ravine during its final design for the slope re-configuration and cover system. Additional site-specific data was recently collected for this and will be used in the future design work.

8) ODOT & EMD Action Item
Hold a third meeting to continue the dialogue, maintain channels of communication, and update all parties on the status and results of the Action Items. Meeting to be scheduled when action items near completion but currently anticipated to occur in November 2005.

9) ODOT Action Item
ODOT is to meet with and update personnel of the Federal highway agency (Mark Vonder Embse and Dick Henry) and provide EMD with a list of Action Items to be addressed, if any.

10) EMD Action Item
Evaluate the feasibility of removal of waste from ODOT property.

Meeting Agenda
Second ODOT/EMD Discussion of Corrective Measures in ODOT/Norfolk Southern R/W
August 25, 2005

Introductions

Julie Denniss, Environmental Services (**ODOT**)
Cash Misel, Assistant Deputy Director (**ODOT**)
Andrew Gall, Director's Office (**ODOT**)
Howard Wood, Deputy Director of Planning (**ODOT**)
Michael Flynn, Deputy Director District 8 (**ODOT**)
Tim Hill, Administrator Office of Env. Services (**ODOT**)
Andrea Stevenson, Office of Env. Services (**ODOT**)
Tom Pannett, Chief Legal (**ODOT**)
Tim Killeen, Office of Env. Services (**ODOT**)
Mark Clark, Planning District 8 (**ODOT**)
Chris Hilbert, District 8 Permits (**ODOT**)
Greg Patton, Planning District 8 (**ODOT**)
Gene Geiger, Administrator, Office of Geotech Eng (**ODOT**)
Mike Mulligan (**EMD**)
Paul Nelson (**EMD**)
Kathy Arnett (**CH2M HILL**)
Mark Altic (**CH2M HILL**)
Doug Briggs (**CH2M HILL**)
David Dickey (**CH2M HILL**)
Dan Weed (**The Payne Firm**)
Don Heller (**USEPA R5**) – via conference call
Kevin Hodnett, Office of Env. Services (**ODOT**)
Dirk Gross, Administrator, Office of Roadway Services (**ODOT**)

Safety Moment

Presentation – EMD Approach to Corrective Actions

- Brief site overview
- Current understanding of ODOT concerns
- Site activities since our last discussion with ODOT in 1995
- Conceptual Model of Current Conditions
  - Soils contamination and fate and transport of groundwater contamination
  - Migration of contaminated groundwater under control
  - Evaluation of off-site risk to human health & environment due to off-site soil and groundwater contamination in ODOT R/W
- Corrective Measures Plan
  - Waste in place management/hydraulic GW interception system
  - Proposed hydraulic containment trench placement and operation
  - Discussion of alternatives considered/justification of currently proposed CM
- Discussion of ODOT Concerns/Solutions
- Schedule for Project Delivery
- Discussion of issues/questions from ODOT/Capture of Action Items

Adjourn meeting

EMD / ODEQ CONFERENCE CALL
8-25-05

[illegible] yet established POC – Dark Creek or facility boundary ?

EMD [illegible] 100–200 g/day flow into the capture trench, [illegible] flow. Trench [illegible] ~15' deep, it [illegible] excavated directly into contaminated soil, thereby excavating some of the off-site contamination and accelerating natural attenuation.

ODEQ [illegible] about future [illegible]. Is EMD going to [illegible] 15 years [illegible] ?

[illegible], ODEQ [illegible] exactly what [illegible] plan [illegible] that part of [illegible].

[illegible] asked at what time [illegible] the capture trench no longer be needed – or no longer effective. EMD answered that they don't really know. Buried containers of waste may periodically break under gravity, thus releasing new [illegible] of [illegible]. [illegible] asked if regrading and compacting the slope w/ heavy equipment would shatter more buried containers. [illegible] said that would be a possibility.

KHogan @ [illegible] . com

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGIONS 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF:

DW-8J

CERTIFIED MAIL: 7001 0320 0006 0202 5868
RETURN RECEIPT REQUESTED

December 8, 2005

Mr. Michael C. Mulligan
Vice President, Operations
EMD Chemicals, Inc.
2909 Highland Avenue
Cincinnati, Ohio 45212

RE: Request for Time Extension for Submission of Corrective Measures Proposal
EMD Chemicals, Inc. OHD 086 438 538

Dear Mr. Mulligan:

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The request states that both the Ohio Department of Transportation (ODOT) and the Norfolk Southern (NS) Railroad are contemplating whether to allow construction of EMD's proposed leachate/ground water collection trench on their properties. These continuing negotiations have made it necessary for an extension of the due date for submission of the CMP to U.S. EPA.

Based upon the information which you have provided, your request for the June 30, 2006, due date is hereby granted.

Be advised that U.S. EPA will abide by the decisions of both ODOT and the NS Railroad as to whether or not any portion of the final corrective measures may be constructed on their properties.

U.S. Postal Service
CERTIFIED MAIL RECEIPT
(Domestic Mail Only; No Insurance Coverage Provided)

OFFICIAL USE

Postage	$ 37
Certified Fee	230
Return Receipt Fee (Endorsement Required)	175
Restricted Delivery Fee (Endorsement Required)	
Total Postage & Fees	$ 442

Postmark Here
DEC 9 2005

7001 0320 0006 0202 5868

Sent To: M. Mulligan / EMD Chemicals (Heller DW-8J)
Street, Apt. No.; or PO Box No.: 2909 Highland Ave.
City, State, ZIP+4: Cincinnati, OH 45212

PS Form 3800, January 2001 — See Reverse for Instructions

SENDER: *COMPLETE THIS SECTION*

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Michael Mulligan
EMD Chemicals, Inc.
2909 Highland Ave.
Cincinnati, OH 45212

COMPLETE THIS SECTION ON DELIVERY

A. Received by *(Please Print Clearly)*: Sheree Helton — B. Date of Delivery: DEC 13 2005

C. Signature: X Steve McKay — ☐ Agent ☐ Addressee

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☒ Certified Mail ☐ Express Mail
☐ Registered ☐ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? *(Extra Fee)* ☐ Yes

2. Article Number *(Co* 7001 0320 0006 0202 5868

PS Form 3811, July 1999 — Domestic Return Receipt — 102595-99-M-1789

Please contact me at (312) 353-1248 if you have questions.

Sincerely,

Donald A. Heller

Donald A. Heller, Environmental Scientist
Corrective Action Section
Waste Management Branch

cc: Joe Smindak, OEPA – SWDO
Mark Altic, CH2M Hill

Report

Final Draft Corrective Measures Proposal

U.S.EPA ID #
OHD 086-438-538

Prepared for

EMD Chemicals Inc.

Cincinnati, Ohio

June 2006
Revision 1 – November 3, 2006
Revision 2 – February 20, 2007

CH2MHILL
One South Main Street
Suite 1100
Dayton, Ohio 45402

Report

Final Draft Corrective Measures Proposal

Submitted to

U.S. Environmental Protection Agency

June 2006
Revision 1 – November 3, 2006
Revision 2 – February 20, 2007

Contents

1.0 Introduction

EMD Chemicals Inc. (EMD) entered into a Voluntary Corrective Action Agreement (VCAA) with U.S.EPA in September 2004 to expedite completion of RCRA Corrective Actions at their Cincinnati, Ohio facility. Working collaboratively with U.S.EPA under the VCAA, EMD has completed the site investigation, developed a conceptual model of site conditions, demonstrated that both Environmental Indicators (EI's), *Current Human Exposures Under Control - Environmental Indicators RCRIS Code (CA725)* and the *Migration of Contaminated Groundwater Under Control - Environmental Indicators RCRIS Code (CA750)* have been met, and characterized the potential risk associated with site conditions. Pursuant to Section V-D-1 of the VCAA Agreement, EMD has prepared this *Corrective Measures Proposal (CMP)* to outline corrective measures which will continue to protect human health and the environment from unacceptable risks associated with releases of hazardous waste and hazardous constituents at or from the Facility.

This *Draft CMP* presents information summarized from the following documents which are referenced by their respective numbers through this report:

(1) *Remedial Investigation* (TPF, 1996)

(2) *Feasibility Study Report* (TPF, 2000)

(3) *Feasibility Study* (Ohio EPA, 2004)

(4) *Draft Conceptual Model of Current Conditions* (CH2M HILL, 2005)

(5) *Conceptual Model of Current Conditions* (CH2M HILL, 2006c)

(6) *Human Health Risk Assessment Addendum* (CH2M HILL, 2006a)

(7) *Technical Memorandum – Update for the Human Health Risk Assessment Addendum of Off-Site Soils* (CH2M HILL, 2006b) (included as Appendix B to the *Human Health Risk Assessment Addendum*)

(8) *Current Human Exposures Under Control - RCRA Corrective Action Environmental Indicator (EI) RCRIS Code CA725* (Ohio EPA, 2002)

(9) *Draft Migration of Contaminated Groundwater Under Control – RCRA Corrective Action Environmental Indicator (EI) RCRIS Code CA750* (CH2M HILL, 2005)

(10) *Conceptual Agreement for Corrective Measures Plan* – EMD Chemicals Inc. Cincinnati Facility (EMD, 2006)

Public participation has occurred per the VCAA, and EMD has provided previous notification to the public of relevant activities performed under Ohio EPA's lead. Copies of all applicable reports have been made available at the Cincinnati Public Library (Norwood Branch) in Cincinnati, Ohio for the public to review.

This *Draft CMP* has been structured to provide all of the information necessary for U.S.EPA to make a final remedy decision and for use in preparing a Statement of Basis. The *CMP* is organized as follows:

Section 1.0 - Introduces the site, brief background, and purpose of document.

Section 2.0 - Provides an overview of corrective action objectives, agreed to performance standards, and the proposed corrective measures to address objectives/standards.

Section 3.0 - Presents the facility background, overview of the site conceptual model, current and reasonably foreseeable future land use, and interim measures performed to date.

Section 4.0 - Presents an overview of the site conceptual model, contaminants of concern, and a summary of facility risks to be addressed by the proposed corrective measures.

Section 5.0 - Presents a brief overview of the remedy alternatives assessed in previous feasibility studies.

Section 6.0 - Presents a summary of the scope of corrective action and the proposed components of corrective measures.

Section 7.0 - Presents an evaluation of the proposed components of corrective measures.

Section 8.0 - Discusses public participation in the corrective measure process.

Section 9.0 - References

2.0 Overview of Corrective Action Objectives and Proposed Corrective Measures

Consistent with the purpose of the VCAA, as discussed with U.S.EPA on March 10, 2006, and as summarized in the *Conceptual Agreement for Corrective Measures Plan* (10), EMD and U.S.EPA have agreed on the following Corrective Action Objectives (CAOs) for the Cincinnati Facility:

- Maintain protective conditions
- Implement safe, technically and economically feasible corrective measures
- Effective and sustainable long-term operation, maintenance & monitoring
- Reduce environmental liability
- Minimal disruption of facility operations

EMD proposes the following corrective measures to meet these CAOs:

- Removal of off-site waste and consolidation with on-site waste
- Containment and management of on-site waste in-place
- Containment of contaminated groundwater
- Institutional controls

The following Performance Standards are being proposed to demonstrate that the corrective measures are functioning as necessary to meet the CAOs. These Performance Standards were discussed with, and conceptually agreed to by U.S.EPA during the March 10, 2006 meeting (10):

<u>On-Site Performance Standards</u>

- Effectiveness of containment (waste and contaminated groundwater) will be demonstrated through the following observations:
    - Stable surface conditions maintained in areas indicative of subsidence.
    - Concentration levels of contaminants in groundwater do not increase and will likely decrease.
- Effectiveness of engineering controls demonstrated through inspection of the following:
    - Site cover integrity monitored for cracks (structures) or erosion (soil cover).
    - Site fencing effectiveness as an access control.
- Demonstration that appropriate institutional controls are in place:
    - Deed restriction to industrial land use is filed.
    - Site operational practices and controls implemented to protect workers.

Off-Site Performance Standards

- Visible and accessible wastes associated with on-site activities (consisting of concrete demolition debris, broken or whole bottles containing off-spec chemicals) will be removed.
- Off-site soils identified as being impacted through visual or screening level observations (e.g. photo ionization detector) in the vicinity of the existing off-site sump system will be removed to the extent practical during construction. Excavations will be limited to physical restraints (road, railroad bridge, etc.). Confirmatory soil sampling will not be necessary or conducted.
- Cleanup standards for off-site groundwater will be risk-based levels for COCs associated with EMD facility:
    - Standards to be calculated based on appropriate and currently identified exposure scenarios for current and reasonably anticipated future land use (a construction worker entering an excavation in the affected area of the transportation corridor).
    - MCLs are not applicable because perched groundwater is not a drinking water source and therefore ingestion is not a relevant exposure pathway.
- Point of compliance is the property boundary.

The corrective measures will be designed and implemented to meet the Performance Standards identified above. At this time EMD anticipates the measures to consist of the following elements:

- An on-site groundwater collection trench and low permeability containment wall along the southern property boundary to intercept groundwater containing COCs to ensure groundwater migrating off site potentially containing COCs continues to remain below risk based levels; this will include the construction of new collection sump on EMD's property to replace and upgrade the existing off-site sump and the removal of off-site waste/placement of waste in the on-site portion of the West Ravine;
- A new surface cover system over a portion of the West Ravine and modifications to the storm water management system to reduce surface water infiltration into the West Ravine;
- Continued operation of the existing French Drain groundwater collection system to prevent the migration of COCs in groundwater to the eastern property boundary;
- Institutional and engineering controls to eliminate potential and future human health exposure pathways; and,
- Long term monitoring to assess the performance of the corrective measures.

In addition to these corrective measures, EMD has elected to perform the following enhancements, beyond measures necessary to achieve protective site conditions. These additional measures have been designed to provide contaminant mass removal:

- In-situ remediation of impacted soils located in the former tank farm area; and,
- Limited excavation of impacted soils in the vicinity of the existing off-site sump system.

CAOs and Performance Standards will be met by the proposed corrective measures as follows:

- Prevent exposure to on-site impacted soils or groundwater during excavation activities through use of EMD facility engineering controls;
- Prevent future exposure to on-site impacted soils or groundwater during excavation activities with institutional controls that will run with the land (deed restrictions);
- Prevent on-site exposure to indoor air vapors with EMD facility engineering controls;
- Continue to prevent on-site contaminated groundwater from migrating beneath the eastern property boundary;
- Continue to prevent on-site storm water from coming into contact with buried waste;
- Ensure that impacted off-site groundwater south of the site that contains contaminants of concern below risk based goals as defined in the human health risk assessment, remains below risk based goals through containment of impacted groundwater along the southern property boundary and periodic monitoring to ensure effectiveness; and,
- Remove all off-site visible waste (debris) and a limited amount of contaminated soil in the vicinity of the existing off-site sump system (readily accessible and removal action non-detrimental to existing structures).

3.0 Facility Background

Facility background information, summarized here, can be found in the *RI/FS* (1, 2, and 3) and in the *CMCC* (5).

3.1 Site Description

The EMD Chemicals Inc. Cincinnati, Ohio site (EMD) is located at 2909 Highland Avenue, Cincinnati, Ohio near the interchange of US Interstate 71, Ohio State Route 562, and a Norfolk Southern (NS) railroad line (see **Figure 1 – Site Vicinity Map**). The western 6.62 acres of the site fall within Norwood city limits and the eastern 2.38 acres fall within Cincinnati city limits (1). The site is an active facility with the majority of the area being covered with asphalt, gravel, or concrete. A fence surrounds the property and 24-hour, active security is maintained to limit access to authorized personnel. Along the southwestern portion of the site, a 50-foot wide tree and grass covered hillside drops in elevation from the site to Ohio Department of Transportation (ODOT) and NS right of ways. The topography of the site previously included two ravines, the West and East Ravines, associated with the Duck Creek drainage system. Except for the mouth of the West Ravine, the two ravines have been filled to grade from approximately 1952 to 1971. The mouth of the West Ravine consists of steep slopes carved in fill material that is vegetated with trees and brush. A drainage pipe at the mouth of the West Ravine allows perched groundwater to drain from the filled portions of the ravine. This drainage is intercepted by Sump 562.

3.2 Land Use

The property is located in a mixed commercial/industrial setting northwest of the intersection of Interstate 71 and State Route 562, west of a Norfolk Southern railroad, and east of various industrial and commercial properties. Several residential houses are located along Highland Avenue northwest of the site, and there are some residential houses to the southwest. Highland Avenue aligned east to west, bisects the EMD facility (see **Figure 1**).

The *CMCC* (5) indicates that the impacts resulting from historical facility operations do not encroach upon residential or neighboring industrial areas. The *Migration of Contaminated Groundwater Under Control Environmental Indicator RCRIS Code (CA750)*(9) demonstrated that dissolved concentrations of COCs terminate at the 96-inch storm sewer immediately east of the site and the Duck Creek Box Culvert located in the ODOT right of way immediately south of the site (see **Figure 2 – Dissolved Contaminant Plumes**). The land use as a transportation corridor is expected to remain the same for the foreseeable future.

3.3 Site Background

The EMD site has been used for the industrial manufacturing, storage, and distribution of organic and inorganic chemicals since the late 1940's (5). EMD, as their previous entity of EM Science (a subsidiary of EM Industries, Inc.), purchased the property in 1977 unaware of soil or groundwater impacts that previous owners had created (e.g. the subsequently discovered buried waste). Chemical discharges from process buildings and underground pipes are known to have occurred between the 1950's and 1970's (1).

The EMD property north of Highland Avenue, purchased in 1994, does not exhibit evidence of impacts from historical operations (1).

The West Ravine was a 25-foot deep depression that previously cut across the EMD property (see **Figure 3 – Facility Map**). From approximately 1952 to 1971, the West Ravine was backfilled with soils, construction debris, and off-spec chemical waste containers. The West Ravine was eventually filled in and brought to grade by the previous owner to increase the usable area. From the 1950's to the 1970's chemicals were buried in the West Ravine (1).

Additionally, the *Remedial Investigation* (1) identified two other major areas where historical releases occurred: the area immediately south of Building 10 and the area immediately southeast of Building 4 inclusive of the former tank farm. Both of these impacted areas were likely the result of drainage from sewer lines, drains, and process pipes that eventually migrated to the West Ravine. There are also secondary, localized areas of soil contamination which with the area south of Building 10 will be dealt with collectively in this *CMP* as on-site impacts. Details related to previous investigations of releases can be found in the *CMCC* (5) and *Remedial Investigation* (1).

Chemical processes identified in the *Remedial Investigation* (1) that have occurred at this site include the synthesis, purification, formulation, repackaging, and storage of organic and inorganic solvents, liquids, powders, salts, and acids. Historical operations predominantly occurred in a cluster of buildings in the central portion of the EMD property south of Highland Avenue (Buildings 3, 9, 10, 11, and 19 on **Figure 3**) and near the southern boundary at Building 4. A former underground storage tank (UST) tank farm, located in the filled portion of the West Ravine immediately southeast of Building 4, was used for storing organic solvents including 1,4-dioxane (2). The footprint of the former tank farm is located primarily on the west slope of the West Ravine. COCs were likely released from this area due to overfilling of the USTs or from improper chemical handling in the Building 4 area. It is thought that this source contributed to the currently observed concentrations of dissolved 1, 4-dioxane in groundwater and soil in this area.

In summary, the majority of the environmental impacts as identified in the above investigations took place over 25 years ago and include impacted soils and groundwater in the vicinity of the former tank farm (inclusive of the Building 4 area), the area south of Building 10, and buried waste in the West Ravine. The soils south of Building 10 and the secondary on-site soil contamination will be addressed collectively in this CMP as on-site impacts. The COCs for this site, as related to risk assessment, are VOCs of which 1, 4-dioxane is the most mobile.

3.4 Hydrogeological Setting and Contaminant of Concern

3.4.1 Hydrogeological Setting

The geology in the vicinity of the site generally consists of fill underlain by approximately 70 feet of discontinuous sand and gravel within predominantly glacial and lacustrine silt and clay (1). These discontinuous units include the fill, upper till, upper sand, and lacustrine units on **Figure 4 (Perched Groundwater Units)** and contain sparse amounts of groundwater. The groundwater found within these units is considered perched as it is separated from a regional aquifer, the Norwood Trough Aquifer described below, by a series of 10 to 30 feet of unsaturated, low permeability confining layers that act as aquitards. The perched groundwater generally flows to the southeast and is not a plausible source of potable water. Recent calculations have estimated that the flow through the West Ravine units (fill, lacustrine, and upper till) to average 0.5 gallons per minute (gpm) cumulatively, with overall flow rates less than 0.2 feet per day (5). Groundwater gradients range from 0.01 feet/foot (ft/ft) on-site to 0.13 ft/ft near the EMD south property boundary and across the French Drain. The *CMCC* (5) contains a more detailed description of groundwater flow conditions.

The Norwood Trough Aquifer has an upper layer of approximately 85 feet of partially cemented sand and gravel deposits that exhibit low permeability and act as a confining zone (5). Below the confining zone, a confined aquifer, consisting of approximately 75 feet of saturated sand and gravel is present. Subsurface investigations at the site have demonstrated that there is no connection between the perched groundwater and the Norwood Trough Aquifer beneath the site (1). See **Figure 5 (Cross Section Y-Y')** for a stratigraphic cross-section following along the longitudinal axis of the West Ravine.

The nearest surface water is Duck Creek which is a stream approximately 600 feet southeast of the site (see **Figure 1**). Off-site groundwater flow from the fill, lacustrine, and lower clay units eventually drains into the box culvert backfill created for Duck Creek southeast of the site. A more detailed discussion of the site and regional hydrogeology can be found in the *Remedial Investigation* (1) and the *CMCC* (5).

3.4.2 Contaminants of Concern

Initial Site sampling during the early stages of the RI included the list of analytes from 40 CFR 264 (US Code of Federal Regulations), Appendix IX and radionuclides (1). Initial RI investigations focused on sampling the SWMUs/AOCs and the West Ravine area to determine the site-specific parameter list (SSPL). Through assessment of the analytes actually detected at the Site and site-specific knowledge (i.e., chemicals either not used or not known to be present at the Site), the list of constituents to be included in the SSPL for additional assessment was limited to those requiring further assessment in the later stages of the RI. Details of the development of the SSPL are presented in the *CMCC* (5).

Dissolved COCs related to the site, VOCs such as BTEX (benzene, toluene, ethylbenzene, and xylenes), chlorinated VOCs, and 1,4-dioxane, are largely observed in the perched groundwater system (5), specifically the fill, upper till, upper sand, lacustrine unit, and the upper portion of the lower clay as shown on **Figure 4.** The dissolved COCs in the perched groundwater are limited to approximately two-thirds of the site and a down-gradient, off-site area to the

southeast (see **Figure 2**), and dissolved plumes are found to be stable to decreasing. The *CMCC* (5) reviews the discussion on how natural attenuation of chlorinated VOCs in the perched groundwater is occurring, and reducing conditions found across the site.

The COCs have not migrated significantly in soils, and most impacts seen at the mouth of the West Ravine are likely the result of earlier discharges from a 16-inch clay pipe and subsequent overland flow before that pipe was terminated. The 1,4-dioxane concentrations indicate the largest aerial extent of the dissolved concentrations. This is due to the properties of that chemical which has a low affinity to sorb to soil and travels at nearly the rate of groundwater, thus acting like a dye tracer. Extents of COC and additional discussion on fate and transport processes can be found in the *CMCC* (5).

Surface water samples have been collected from Duck Creek at up and downstream locations relative to the facility each quarter since the third quarter of 2004. Dissolved COCs have not been observed above maximum contaminant levels (MCLs) in any of the quarterly surface water samples. In addition, supplemental investigations requested by the U.S.EPA and performed in October 2005 demonstrated that COCs were not present on the south side of the Duck Creek box culvert or in the backfill at the terminus of the Duck Creek box culvert (see **Section 5.1** and **5.2**).

3.5 Interim Measures

Active interim measures, described below, were installed throughout the 1980s and 1990s to ensure that site conditions were protective while conditions and corrective measures were being evaluated. Interim measure details are presented in the *CMCC* (5). Some interim measures will no longer be needed once the final remedy is in place, and others will be incorporated into the final remedy.

Interim Measures to be incorporated into the Remedy:

- A groundwater collection trench (i.e., French Drain) designed to intercept impacted groundwater migrating to the east and southeast of the West Ravine area through the Upper Sand Unit.
- Extraction Well P6A designed to control the hydraulic gradients east of the French Drain (backup system for the French Drain to cut off impacted groundwater migrating off-site to the east).

Interim Measures to be replaced by the Remedy:

- Sump 562 installed at the mouth of the West Ravine (see **Figure 3**) to intercept and collect storm water and seepage from the West Ravine fill.
- The current storm water management system designed to prevent storm water from contacting buried waste, and to allow storm water (waters not impacted by facility operations) to bypass soils and waste in the mouth of the West Ravine (1).

4.0 Summary of Facility Risks

4.1 Potential Human Health Risks

EMD has evaluated potential human health risks associated with the Facility based on industrial land use for on-site conditions. Off-site conditions were evaluated assuming that use of adjacent downgradient properties (ODOT/NS transportation corridor) would remain the same. These risk evaluations presented in the *Remedial Investigation* (1) and the *Human Health Risk Assessment (HHRA) Addendum* (6) reached the following conclusions:

- On-site exposures resulting in risks above U.S.EPA risk reduction goals were found to be associated with the following scenarios:
  - Workers potentially exposed to concentrations in indoor air above U.S.EPA risk reduction goals[1] due to vapors potentially migrating from soils containing high concentrations of VOCs.
  - Construction workers potentially exposed through inhalation of vapors, and through direct contact with soils or waste (resulting in soil ingestion and dermal contact) containing high concentrations of VOCs West Ravine.
- The only identified, complete off-site exposure pathways based on 1996 data was associated with a construction worker scenario in a limited area at the base of the West Ravine (6). In 2006, revised risk calculations performed on soil sample data results from a May 2006 sampling effort. This was accomplished to determine whether current conditions indicate that risks due to COCs have decreased to be at or below risk based levels (7).
- Site contamination does not pose a significant risk to identified or anticipated on-site ecology and no complete or significant ecological receptor exposure pathways were observed on or off-site in relevant areas.

The numerical results for the exposure scenarios considered likely to have complete exposure pathways at the site are summarized in **Table 1** (**Summary Results for Constituents of Potential Concern Contributing the Majority of Risk for Potentially Complete Exposure Scenarios**). The risks estimates presented in **Table 1** are driven principally by observed concentrations of VOCs in soil and groundwater. Additional information on the risk assessment results is summarized in the following paragraphs and is presented in the *HHRA Addendum* (6).

[1] The risk reduction goals for the site are to achieve a target cancer risk within the range of 10^{-6} to 10^{-4}, and to achieve a target non-cancer level of exposure corresponding to a Hazard Index (HI) of one.

4.1.1 Indoor Air Risks

The original *Baseline Risk Assessment* (1) evaluated a range of potential exposure scenarios for the chemicals detected in soil and groundwater at the site. In many cases, these scenarios involved hypothetical future land uses (such as residential land use) and exposure pathways that are highly unlikely to be complete. For the pathways and scenarios likely to be complete, the baseline risk assessment identified potential exposures higher than a noncancer hazard index of one associated with exposures of construction workers. The *HHRA Addendum* (6) updated the baseline risk assessment to include evaluation of risks on-site EMD workers potentially from indoor vapor intrusion.

The excess lifetime cancer risk (ELCR) associated with vapor intrusion of carcinogenic COPCs in soil was higher than $1x10^{-4}$ under a reasonable maximum exposure (RME) exposure scenario, and a noncancer Hazard Index (HI) slightly greater than one. The key assumption for the RME scenario is that an individual is located continuously in a building that is situated over concentrations in both soil and groundwater that represent the 95% upper confidence level (UCL) on the average across the site. This is a conservative estimate of the potential risks, because it is unlikely that the contaminant distribution in soil would achieve these high exposure levels.

It is anticipated that potential vapor intrusion pathways would not affect the ability of EMD to manage occupational health and safety associated with VOCs handled at the facility. Potential inhalation exposures to these VOCs are well below occupational exposure levels. Potential exposure to VOCs stored and handled at the facility are managed through normal operating practices, including engineering controls, industrial hygiene surveillance, and a hazard communication program all of which are consistent with Occupational Health and Safety Administration standards for industrial operations. Therefore, it is anticipated that these practices also would address potential exposures to VOCs potentially from vapor intrusion.

4.1.2 Construction Worker Exposure Risk

The ELCRs for construction workers either in on- or off-site locations fall within the risk reduction range of 1×10^{-6} to 1×10^{-4}, and are not associated with a significant noncancer health risk.

The *Human Health Risk Assessment Addendum, EMD Chemicals Inc.* (HHRA Addendum, CH2M HILL 2005) identified the potential for excess noncancer health effects to construction workers excavating in off-site soil in the area of the mouth of the West Ravine. Based on investigations to date, the soils located in the mouth of the West Ravine contain the highest concentrations of chemicals of concern (COCs) in off-site soils impacted as a result of historical operations conducted prior to EMD site ownership. The noncancer risks were driven primarily by elevated concentrations of carbon tetrachloride detected in soil samples collected by EMD Chemicals Inc. (EMD) from two test borings in 1997. As part of EMD's corrective measures evaluation, these locations were re-sampled for EMD's site-specific target analyte list (TAL) of volatile organic compounds in May 2006 and updated risks were estimated for construction worker exposure to off-site soils.

The resampling in May 2006 of two locations in off-site soils at the mouth of the West Ravine showed substantial decreases in concentrations of carbon tetrachloride in soil. This resulted in corresponding reductions in estimated non-cancer risks to construction workers. Concentrations of other constituents (primarily 1,2-dichloroethane and vinyl chloride) increased in these soil samples. The increased concentrations might be due to a combination of factors, including the formation of degradation products and variability in sampling results. Based on consideration of the conclusions presented in the CMCC that indicate no off-site sources exist, current monitoring data that indicate that concentrations of COCs in groundwater are stable to decreasing, and the presence of interim measures and future proposed corrective measures that will control any potential future releases from the West Ravine by both containing West Ravine waste and intercepting groundwater flowing through the West Ravine area that contains COCs at concentrations above risk based levels, it is unlikely that concentrations of VOCs in off-site soils will increase over time.

The estimated non-cancer hazard index for liver effects in construction workers decreased substantially based on the new sampling results; at the same time, the estimated non-cancer hazard index for kidney effects increased slightly. These changes correspond to the relative decreases in concentrations of some VOCs (carbon tetrachloride) and increases in others (1,2-dichloroethane). Overall, the highest hazard index was 1.1, based on kidney effects from potential exposure to 1,2-dichloroethane.

The key assumption for the RME scenario is that an on-site construction worker is always exposed to the 95% UCL on the average concentrations both in soil and groundwater, and that the worker is always located at the mouth of the West Ravine. Use of the 95% UCL on the average provides a very conservative indication of potential human health risks. Since risks under the RME case do not substantially exceed a noncancer HI of 1.0, it is concluded that soil and groundwater contaminants on-site do not pose significant noncancer health risks to construction workers. However, the potential risk will be actively managed during corrective measures through cover placement and institutional controls, and engineering controls consistent with best management practices.

The HHRA Addendum, inclusive of all modifications discussed herein, was accepted without additional comment by the USEPA on October 25, 2006.

4.2 Off-Site Groundwater

Previously completed reports accepted by U.S.EPA have shown that groundwater migration is under control (9) and that current human health exposure pathways are under control (8). Therefore, active control of impacted groundwater migrating off-site beneath the southern property is not technically required to control current conditions in the impacted area. However, EMD is proposing to install a groundwater containment measure at the property boundary in a proactive approach to assure that COC concentrations remain below risk based goals at the property boundary point of compliance. Off-site remediation of groundwater is neither required nor will be performed actively. It is anticipated that off-site groundwater concentrations will be reduced by natural attenuation over time.

Off-site COC concentrations in groundwater are currently below risk reduction goals for this site (7). Evaluation of potential exposure pathways to concentrations in groundwater took into consideration the industrial/commercial land use classification around the site. Potential exposures and risks were evaluated using current and expected exposure scenarios, and using current reasonably anticipated future land use. Maximum contaminant levels (MCLs) are not applicable to the site because the perched groundwater is not a drinking water source (10).

4.3 Ecological Risks

An ecological risk evaluation completed during the RI process determined that the overall potential for long or short term ecological risks at the site or at associated off-site locations was negligible (1). Relatively few flora or fauna were identified due to the industrial nature of the area.

4.4 Summary of Site Risk Under Current Conditions

Potential risks associated with current site conditions are summarized in the *Remedial Investigation* (1), the *Conceptual Model of Current Conditions* (5) and the *HHRA Addendum* (6). These documents supported the completion of the *Groundwater Environmental Indicator* (9) and *Human Health Environmental Indicator* (8), and conclude the following:

- The only human health risks above U.S.EPA risk reductions goals on site are a potential risk for on-site construction worker scenario for contact with soil or water and an indoor air vapor inhalation risk for on-site workers;
- Observed concentrations of COCs that have migrated off-site are at or below risk based levels – therefore, no off-site risks exist under the current and reasonably foreseeable future industrial land use scenario;
- Off-site surface water is not impacted by groundwater containing COCs; and,
- No significant ecological pathways and risks are present at on and off-site locations.

5.0 Evaluation of Alternatives

As part of the final remedy identification and proposal development, several remedial technologies and actions have been evaluated for their ability to meet CAOs for the Cincinnati site. Corrective Measures Study evaluations have focused on four basic alternatives.

- No Action
- In-Situ Treatment
- Source Removal/Excavation
- Containment with Institutional Controls

Of the four options, on-site containment and limited excavation was found to be the most protective of human health and the environment and cost effective solution. This *Draft CMP* provides a brief summary of the evaluation of these four options. Additional detail on remedy feasibility studies can be found in the original *Feasibility Study Report* (2) and the accepted *Feasibility Study* (3) completed by the Ohio EPA.

5.1 Alternative 1 – No Action

A No Action approach would leave waste, impacted soil and groundwater in place, with no containment or exposure controls. This approach results in the following:

- No protection against potential future releases of chemicals at concentrations above site risk based levels from the West Ravine waste that could migrate off-site; and,
- No controls to prevent the unacceptable risk associated with exposure from:
    - any potential future property owner from excavating into the West Ravine waste;
    - controlling on-site risks associated with indoor air; and,
    - excavating into soils/groundwater containing COCs above site risk based levels for construction workers in affected areas outside of the West Ravine.

Natural attenuation processes would continue; however there would be no means to verify or monitor its progress.

The No Action option does not provide the level of protection for human health and the environment that USEPA and EMD have incorporated into the site's CAOs. Therefore, EMD does not consider the "No Action" alternative to be a viable final remedy.

5.2 Alternative 2 – In Situ Treatment

The in-situ treatments such as soil flushing, bioventing, and hydraulic fracturing were removed from consideration during the screening process because any one treatment cannot address all contaminants of concern and/or would be ineffective due to the physical nature of subsurface geology at the site. This approach would result in the following:

- require multiple technologies to address all chemicals of concern that could not be implemented concurrently;
- inconsistent response from pumping or vapor extraction due to low permeability and heterogeneous nature of the site geology;
- inability of vapor extraction to extract all COCs (i.e. 1,4-dioxane); and,
- would not address buried waste material;

Further discussions related to selection criteria are presented in the original *Feasability Study Report* (2). To summarize, in-situ options do not meet all CAOs for the site, therefore this option was not forwarded for consideration.

5.3 Alternative 3 – Source Removal/Excavation

Though West Ravine buried waste is currently stable, source removal would prevent the potential for unacceptable exposure to hazardous materials and future releases to soils/groundwater. Source removal would require an excavation alternative as follows:

- Excavation of West Ravine waste, stabilization, and transportation to an incineration facility for destruction;
- Excavation of soils driving on-site risks; and,
- Monitoring groundwater to assure risk reduction goals associated with both the construction worker and indoor air exposure pathways.

While removal of waste/soils appears to be a good way to manage and reduce risks, this approach has the following issues:

- Excavation and stabilization of waste during construction present an exposure risk that does not currently exist. Removal and transportation activities could result in unacceptable releases of COCs to human health and the environment, especially due to the mixing of unknown chemicals currently contained in various glass containers included in the West Ravine waste;
- Excavation will likely not address the entire volume of soil or groundwater driving on-site risks due to the logistics of excavating to the depth necessary on an active facility; and,
- Even limited excavation of waste will result in an entire shut-down of EMD's facility operations for possibly months.

Further, many of the issues identified above also make this a cost prohibitive option. Excavation of the mouth of the West Ravine up to the middle of the West Ravine (under EMD facilities) were assessed in the Ohio EPA *Feasibility Study* (3), amounting to **$15 million.** Additionally, based on a listed waste designation for the excavated soil and waste, these materials would need to be destroyed via incineration, which would amount to $150 million in this scenario. The incremental level of protection provided by this option does not justify the huge difference in cost between this and the containment option described below.

5.4 Containment with Institutional Controls

The final set of remedial options evaluated focused on engineering controls to provide containment of waste in the West Ravine (which is currently stable), and institutional controls to prevent exposure. This alternative is protective of human health and the environment (See **Sections 6** and **7** for details) and provides the following benefits:

- On-site containment of identified environmental risks;
- West Ravine waste is maintained in its current stable condition;
- Infiltration of surface water into West Ravine waste is controlled by the cover and storm water management system;
- Any potential future releases of COCs in groundwater from West Ravine wastes would be hydraulically contained thus preventing off-site migration of COCs;
- Capture of groundwater migrating through on-site contaminated soil to continue to assure concentrations of COCs in off-site groundwater remains below risk-based levels and allowing natural attenuation to continue to decrease COC concentrations over time;
- Mass removal of contaminants via groundwater interception and tank basin area remediation;
- No intrusive excavation of waste from the West Ravine during construction that could result in releases that could impact human health and the environment;
- Long term groundwater monitoring at the point of compliance, ensuring the efficacy of the containment; and,
- Institutional controls that will run concurrent with the land to maintain protectiveness into the future.

For the reasons stated above, this option provides the optimum level of protectiveness for human health and the environment during construction and during operation.

The costs to install and operate this remedy are currently under evaluation, and only a very rough estimate can be provided at this time. Considerations must be made in regards to construction activities inside the mouth of the wooded West Ravine, and in not encroaching upon the ODOT/Norfolk Southern Railroad right of way. Initial estimates for construction of this corrective measure are $6.5 million, with approximately $50,000 a year in annual monitoring costs.

6.0 Scope of Corrective Measures

The components of the proposed corrective measure are described below.

6.1 Corrective Action Objectives

The corrective action objectives discussed with, and agreed to by U.S.EPA on March 10, 2006 are:

- Maintain protective conditions;
- Implement safe, technically and economically feasible corrective measures;
- Effective and sustainable long-term operation, maintenance and monitoring;
- Reduce environmental liability; and,
- Minimal disruption of facility operations.

The CAOs will be met by the following corrective measures:

- Removal of off-site waste and consolidation with on-site waste
- Containment and management of on-site waste in-place
- Containment of contaminated groundwater
- Institutional controls

"Figure 3" diagram ?

6.2 Components of the Corrective Measure

The CAOs described above will be achieved through implementation of measure components:

- Groundwater collection trench and low permeability containment wall along the southern property boundary to intercept potential releases from West Ravine contained waste and groundwater containing the highest concentrations of COCs thus preventing off-site migration of COCs above risk-based levels; this will include the removal of the existing off-site Sump-562 and replacing it with a new on-site upgraded sump located in the trench;
- Off-site waste (debris) will be removed and incorporated into the containment system;
- Continued operation of the existing French Drain collection system to prevent COCs in groundwater from migrating to the eastern property boundary;
- New surface cover and storm water management system over the entire known aerial extent of the buried waste in the ravine to reduce surface water infiltration into the West Ravine; and,
- Institutional and engineering controls to eliminate potential and future on-site human health exposure pathways.

As previously noted, the existing French Drain and (as a backup system) the Recovery Well P6A, interim measures will become an integral part of the proposed remedy and the containment strategy. Additionally, components of the facility modernization plan will be included into the overall corrective measures as part of the ravine cover system described above.

In addition to the proposed containment components of the remedy, EMD has elected to perform the following enhancements (not considered a necessary component of corrective measures) designed to provide contaminant mass removal:

- In-situ remediation of impacted soils located in the former tank farm area; and,
- Limited excavation of impacted soils in the vicinity of the existing off-site sump system.

6.2.1 Containment of Waste/Groundwater

6.2.1.1 Containment of Groundwater Via Collection Trench/Low Permeability Containment Wall

Contaminated groundwater that is migrating towards the southern property boundary will be collected in an interceptor trench to prevent off-site migration of COCs above risk-based goals. Although the groundwater migrating off-site to the southwest does not contain COCs at concentrations above current land use scenario risk based goals, capturing this groundwater will ensure that concentrations of COCs that have already flowed off-site (but are already below current land use scenario risk levels) will be reduced over time through natural attenuation.

The groundwater collection trench will be installed in the area shown in **Figure 6 – Groundwater Collection Trench Map**. The trench will be constructed to the elevation of the bottom of the Lacustrine Unit, and will be filled with permeable drain rock to promote gravity flow to a central sump. From the sump, the impacted groundwater will be pumped back to the EMD facility and will be discharged to the local publicly owned treatment works under the existing permit (to be modified if required).

In addition to a collection trench, a low permeability containment wall will be installed hydraulically downgradient of the collection trench. The wall will provide structural protection for the collection trench, and will provide a secondary benefit of added containment. The wall will extend along the property line, and will be designed such that potential future expansion to the highway alongside the EMD property will not adversely affect the long term integrity of the remedy. This containment wall will be installed prior to the groundwater collection trench for easier construction of the trench and to provide a measure of isolation of construction activities from State Route 562.

Water collected at the French Drain and Sump-562 is currently processed through the existing pre-treatment and pH neutralization system, then discharged to the Publicly Owned Treatment Works (POTW) under EMD's existing permit. As agreed to by the U.S.EPA on March 10, 2006 and in the *Conceptual Agreement of Corrective Measures* (10), groundwater collected by the proposed southern property and new on-site sump will be processed and discharged with the groundwater collected by the French Drain to be carried forward as part of the final remedy. EMD's existing permit with the POTW will be modified as required.

6.2.1.2 Containment of Groundwater Via French Drain/Well P6a System

The existing French Drain groundwater collection system will continue to operate to prevent impacted groundwater from migrating to the eastern property boundary. This system captures groundwater in the Upper Sand Unit located beneath the central portion of the property. Recovery Well P6a will be retained as a backup to the French Drain system.

6.2.1.3 Containment of Waste Via Ravine Cover / Storm Water Management System

Though current calculations indicate very low hydraulic conductivities in the range of 10E-9 to 10E-6 centimeters/second for the lacustrine unit (the highest permeable and impacted depositional unit at the base of the West Ravine), EMD has chosen to virtually eliminate the amount of surface water that could potentially infiltrate to the mouth of the West Ravine as an enhancement to the containment process. EMD will accomplish this by filling the remainder of the West Ravine up to grade and covering the area with low permeability cover. The containment wall will be extended to the EMD facility elevation (approximately 606 feet mean sea level) and engineered fill and excavated soil from the collection trench construction will be placed in the containment area of the West Ravine. The fill material will be leveled, and the low permeability cover system will be installed over the fill. This cover system will be extended to cover the existing filled portion of the West Ravine area as shown on **Figure 7 (Proposed Areal Extent of New Surface Cover)**. A generalized cross-sectional schematic of the cover system is shown on **Figure 8 (Conceptual Cross Sectional Schematic of West Ravine Cover System)**. Reconsolidated site soils and compactable fill from an external source will be used to bring the mouth of the West Ravine to the same elevation as that of the surrounding site. All fill material will be compacted in lifts. The thickness of concrete and aggregate base installed on top of the compacted fill will be sufficient to allow for truck traffic and storage. No buildings (with the possible exception of non-occupied equipment/material storage shelters) will be constructed over known waste depositional areas of the West Ravine with the current plan for the area to serve as a parking and staging area for the facility. The cover system will serve to virtually eliminate the amount of surface water that would otherwise infiltrate and could come into contact with the buried waste material, and to prevent accidental dermal exposure with impacted soils.

As part of facility modernization and the proposed corrective measures, storm water will be managed through an upgrade of the existing system to be compatible with the new surface cover system. This system will aid the surface cover system in preventing storm water from ultimately leaching into West Ravine waste. Storm water will be captured and diverted away from the West Ravine area through conveyance piping that will ultimately deliver the storm water to Duck Creek.

6.2.2 Removal of Off-Site Waste

During construction activities, visible and accessible wastes associated with on-site activities will be removed from off-site construction areas. This waste is thought to include concrete demolition debris. Additionally, this waste could include broken or whole bottles of off-spec chemicals that were historically buried in the West Ravine. However, a review of investigations

and historical information indicates that this is unlikely or if this type of waste exists, it is very minimal. This waste will be placed into the West Ravine to be managed in place within the containment system.

6.2.3 Vapor Controls through Institutional and Engineering Controls

Institutional and engineering controls are proposed to manage the potential on-site indoor air exposure pathway identified in the *HHRA Addendum* (6). The potential excavation exposure pathways will be addressed on-site through currently practiced facility guidelines and physical indoor air management.

EMD will create and utilize documented facility guidelines and health and safety plans to ensure that all staff and subcontractors adhere to the site-specific health and safety plan. The 24-hour surveillance and fencing of the facility prevents unauthorized and uninformed personnel from accessing the site and circumventing these controls. Current normal operating procedures and industrial hygiene practices in conjunction with adequate indoor air exchange via building ventilation systems will continue to prevent exposure by assuring workers are protected via personal protective equipment (PPE)/operating procedures and air exchange rates are great enough to provide the necessary level of protection against potential vapor intrusion.

A documented facility management plan will be created and remain in place to detail the indoor air quality control procedures.

6.2.4 Institutional Controls

Institutional controls are proposed to manage the potential on-site construction worker exposure pathways identified in the *HHRA Addendum* (6). This potential excavation exposure pathway will be addressed on-site through currently practiced facility guidelines and through the filing of a deed restriction for the property. EMD will create and utilize documented facility guidelines and health and safety plans to ensure that all staff and subcontractors adhere to the site-specific health and safety plan when performing subsurface excavation work. The 24-hour surveillance and fencing of the facility prevents unauthorized and uninformed personnel from accessing the site and circumventing these controls.

These procedures will be a part of the documented facility management plan that will detail the subsurface work restrictions.

A land use restriction limiting the land to industrial uses only will be enacted through a deed restriction and be carried with the property through all land ownership transfers (run concurrent with the land). The deed restriction will serve to deter the following:

- Residential or recreational use of the property;
- Subsurface excavations without proper controls and PPE;
- Potable use of perched groundwater; and,
- Construction of buildings without proper engineering and institutional controls.

6.2.5 Remedy Enhancement – Tank Farm Remedy

To enhance the containment element of the final remedy, EMD is proposing to perform additional measures to reduce the soil and groundwater concentrations in the former tank farm area, thereby reducing the source of long-term groundwater contamination. Although this remedy is not necessary for the remaining components of corrective measures to be successful since groundwater from this area is captured by the collection trench, reducing the source of contamination may reduce duration over which the trench system is needed.

Based on existing data, the approximate aerial extent of total VOCs in fill soils in the former tank farm area and the approximate vertical extent have been interpreted as shown on **Figure 9 – Total VOC Concentrations in Former Tank Farm Area** and further described in the CMCC (5). VOC contaminants in soil consist primarily of 1,4-dioxane, chlorinated hydrocarbons, and lower concentrations of benzene (1).

Source reduction is the goal of the tank farm remedy enhancement. Initially, the remedy enhancement will likely consist of an in-situ treatment to address soil and groundwater containing 1,4-dioxane. Additional in-situ technologies may be subsequently applied to target reduction of CVOC concentrations that are sorbed to soil particles. Treatment options are being developed and will be implemented during or following installation of the proposed corrective measures presented herein.

6.2.6 Remedy Enhancement - Limited Excavation of Off-Site Soils

As previously discussed, Sump 562 will be removed during construction of the interim measures. As part of the removal, EMD has elected to perform additional source removal of soils around Sump 562 identified as being impacted based on visual screening and field instruments (e.g. photo ionization detector) will be removed to the extent practical. Such excavated soils will be limited by physical barriers such as the adjacent railroad bridge and highway. As agreed to in the *Conceptual Agreement for Corrective Measures* (10), no confirmation soil sampling is required nor will be completed as a result of the excavation of off-site debris or impacted soils.

6.3 Performance Standards

Performance Standards for containment agreed to by U.S.EPA and EMD during the March 10, 2006 meeting are:

<u>On-Site Performance Standards</u>

- Effectiveness of containment (waste and contaminated groundwater) will be demonstrated through the following observations:
    - Stable surface conditions maintained in areas indicative of subsidence.
    - Concentration levels of contaminants in groundwater do not increase and will likely decrease.

- Effectiveness of engineering controls demonstrated through inspection of the following:
    - Site cover integrity monitored for cracks (structures) or erosion (soil cover).
    - Site fencing effectiveness as an access control.
- Demonstration that appropriate institutional controls are in place:
    - Deed restriction to industrial land use is filed.
    - Site operational practices and controls implemented to protect workers.

Off-Site Performance Standards

- Visible and accessible wastes associated with on-site activities (consisting of concrete demolition debris, broken or whole bottles containing off-spec chemicals) will be removed.
- Off-site soils in the vicinity of the existing off-site sump system identified as being impacted through visual or screening level observations (e.g. photo ionization detector) will be removed to the extent practical during construction. Excavations will be limited to physical restraints (road, railroad bridge, etc.). Confirmatory soil sampling will not be necessary or conducted.
- Cleanup standards for off-site groundwater will be risk-based levels for COCs associated with EMD facility:
    - Standards to be calculated based on appropriate and currently identified exposure scenarios for current and reasonably anticipated future land use (a construction worker entering an excavation in the affected area of the transportation corridor).
    - MCLs are not applicable because perched groundwater is not a drinking water source and therefore ingestion is not a relevant exposure pathway.
- Point of compliance is the property boundary.

6.4 Performance Monitoring

The general monitoring program envisioned to demonstrate that Performance Standards will be met by the proposed corrective measures will consist of following elements:

6.4.1 Containment

Performance monitoring for containment will consist of the following:

- Engineering controls installed to virtually eliminate surface water infiltration into the waste and aid in the prevention of direct contact with contaminated soils will be demonstrated through visual monitoring for cracks in surface cover or buildings, subsurface subsidence, and visual monitoring for soil erosion;
- Groundwater level monitoring demonstrating hydraulic containment at the point of compliance through potentiometric surface mapping; and,

- Monitoring of effluent from the hydraulic containment trench will be performed to determine if releases of chemicals from the West Ravine waste are occurring due to a spike in VOC concentrations.

Risk reduction goals (as discussed in **Section 4**) will be used as *CMP* performance standards at the property boundary point of compliance (defined as the southern property boundary from the western extent of EMD property to the NS railroad bridge; and the eastern property boundary from the northeast property corner to the NS railroad bridge). MCLs are not applicable because groundwater is not used as drinking water. Therefore, risk reduction goals have been met for off-site groundwater and the demonstration of hydraulic containment will suffice as the demonstration of continuing to meet risk reduction goals during operation of corrective measures.

Containment will be confirmed through groundwater level monitoring of the monitoring wells utilized in the pre-remedy installation quarterly groundwater sampling events (**Table 2 - Performance Monitoring Well Schedule**). During the first year of this proposed monitoring, water levels will be gauged on a quarterly basis to demonstrate that hydraulic control is being achieved by the corrective measures and to establish a baseline for groundwater flow with the remedy in place. For four years following this one-year demonstration, the number of monitoring wells and the frequency of gauging will be reduced to a subset that will monitor significant departures from the baseline conditions that could indicate hydraulic capture may not be occurring. The number of wells and frequency of monitoring will be evaluated based on the data and the new monitoring plan will be transmitted to the U.S.EPA. Termination standards for groundwater monitoring will include a consistent demonstration of the system to maintain hydraulic containment for a period of 5 years.

Should water levels indicate that hydraulic control is not being attained, groundwater samples will be collected from a subset of monitoring wells and be analyzed for site COCs. The purpose of the sampling will be to assure that the interpreted lack of hydraulic control in an area of the site is not resulting in COCs migrating off-site at concentrations above site specific risk based levels. Determination of monitor wells to be sampled would be based on an evaluation of the hydraulic data.

Effluent monitoring will begin concurrently with the monitoring well static water level gauging. Effluent monitoring for site COCs will be performed on a monthly basis for the first two years at which time the sampling schedule can be re-evaluated. Concentrations observed in the effluent will be measured against the POTW permit requirements, though not be used for determinations of risk as that will be accomplished through the monitoring well sampling described above.

Visual inspections of applicable remedy components will occur monthly for the first year and quarterly for the next 4 years. At the end of 5 years of monitoring, monitoring frequency will be re-evaluated. Surface inspections will consist of visual observations of the entire surface cover in the area of the remediation system to determine if subsidence, erosion, or significant fractures of the cover are present. Visual inspection of the retaining wall for seeps and the security fence for integrity issues will also be performed.

A complete monitoring plan will be developed and submitted to U.S.EPA after the proposed remedy has been constructed.

6.4.2 COC Monitoring

To assess the post-implementation trend of COC concentrations in off-site groundwater, groundwater samples will be collected from select monitoring wells by the following schedule:

- 1 – 3 years post operation – Semi annually in April/May and in October/November
- 4 – 5 years post operation – evaluate first 3 years of data to assess containment/likely change to annual monitoring
- Beyond 5 years post operation – assess if any additional monitoring is necessary

The purpose of the 1 – 3 year proposed schedule is to perform COC monitoring at the typical high precipitation period (April/May) and low precipitation period (October/November) times of the year. If data trends indicate that the hydraulic containment system is achieving containment via the groundwater level data (as discussed in **Section 6.4.1**) and COC concentrations remain stable or are decreasing, COC monitoring will be changed to annual. If EMD and U.S.EPA agree that concentrations are stable to decreasing after 5 years of COC monitoring, additional scheduled monitoring is not currently anticipated to be necessary. However, EMD may elect to conduct additional monitoring at its discretion at any time beyond the 5-year monitoring schedule outlined above.

The list of wells to be monitored for COCs during post implementation will be included in the complete monitoring plan discussed in **Section 6.4.1**.

6.4.3 Institutional Controls

Institutional controls will include the filing of a deed restriction and documented site operational procedures to protect workers.

A deed restriction that outlines the restrictions placed upon the property will be filed with the Hamilton County Ohio Auditor's Office for placement on the property deed. Once accepted by Hamilton County, a copy of the approved deed restriction will be provided to U.S.EPA.

The facility management plan will be used as an integral part of EMD's health and safety program. The document will be on file at EMD's facility and available for inspection by U.S.EPA upon request.

7.0 Evaluation of Proposed Corrective Measures

This evaluation demonstrates why the proposed remedy is appropriate to address unacceptable risks at the site. The proposed remedy was evaluated against the site-specific corrective action objectives presented in **Section 2.0** and U.S.EPA's remedy selection criteria, as described in the following paragraphs.

7.1 Containment

Effectiveness:
The hydraulic barrier created by installing the groundwater collection trench along the southern property boundary will be effective in intercepting groundwater flowing through waste contained in the West Ravine and on-site soils containing COCs at the southeast portion of the site, near the mouth of the West Ravine. The trench will extend to the bottom of the Lacustrine Unit. By creating a layer of highly permeable material in the trench, groundwater will naturally migrate into the trench and towards the extraction sump via gravity drain. Groundwater will then be extracted via extraction at the sump. To summarize, the trench will intercept groundwater flow through the Lacustrine, Upper Till, and Fill Units where the trench is present.

Additionally, the low permeability containment wall will serve as a secondary hydraulic barrier. The wall will provide structural protection for the collection trench, and will provide a secondary benefit of added containment. The wall will extend along the property line, and will be designed such that potential future expansion to the highway alongside the EMD property will not adversely affect the long term integrity of the remedy.

Long-term Reliability:
The groundwater collection trench technology has proven reliable in past installations throughout the country. This remedy is anticipated to be reliable over the long-term.

Maintenance of the collection trench may be required in the future and features will be designed into the trench to facilitate periodic maintenance (i.e. flushing of precipitants). Overall reliability will partially depend on consistent operation and maintenance of the collection system, particularly the operation of the pumps to maintain an inward gradient to the trench.

Constructability:
The groundwater collection trench will be constructed using an appropriate construction method. The construction method will be chosen to install the trench to the depth and width required for this site considering the topography, hydrogeology and performance goals. Site visits by construction contractors have provided viable options towards completing this trench.

The containment wall construction method is currently being finalized. However, methods considered constructible in this situation have been identified.

Implementation Risk:
Risks associated with the implementation of the collection trench are primarily associated with the excavated material. This material may contain VOCs and off-specification chemicals that were disposed in the ravine in the past. Exposure to workers will be minimized through the use of personal protective equipment. During construction, vapor exposure will be limited by engineering control, including using the fill material that will be placed on top of the West

Ravine waste to decrease grade/allow equipment access, and any additional vapor control measures deemed necessary. Should conditions deteriorate so that the initial engineering controls are not adequate, secondary methods will be employed. Details regarding the construction methods and safety procedures will be given in the construction report following corrective measures construction. Additionally, the containment wall will provide a measure of isolation from the nearby State Route 562.

7.2 Ravine Cover System

Effectiveness:
The engineered fill to be placed in the ravine will be semi-angular such that it promotes drainage of any water migrating through West Ravine waste and out of the current face of the West Ravine to the groundwater collection trench, can be compacted to minimize settling, and provide an appropriate sub-grade for the low permeability cover. The low permeability cover will act as a barrier to surface water and direct site storm water via gravity to the catch basins. The cover will be gently sloped downward from the top of the containment wall to the storm water catch basins. The cover system is expected to effectively keep the majority of surface waters from contacting buried waste material or migrating off-site. The low permeability cover system will act as a vapor barrier and minimize the potential for vapor migration from the former ravine. No waste will be visible or accessible once the cover is in place.

Long-term Reliability:
Aside from routine re-surfacing, the cover system will require little or no maintenance, and is expected to be highly reliable in the long-term. The integrity of the cover system will be demonstrated through periodic monitoring for cracks or erosion. Monitoring is recommended as monthly for the first year and then quarterly for the next four years, the frequency of monitoring then being open for revision. Any maintenance required will be performed by EMD and will also be a requirement in the deed restriction that will run concurrently with the land.

Constructability:
The engineered fill placed in the ravine and the associated low permeability cover system is readily available from local vendors. The containment wall will be appropriately designed to support the volume of backfill to be placed against it. Numerous similar cover systems have been successfully constructed in the past.

Implementation Risk:
Implementation risks associated with the low permeability cover system are low. Construction methods and safety procedures are routine and well-established.

7.3 Tank Farm Remedy

Effectiveness:
An in-situ technology will be implemented in the former tank farm area. This remedy is expected to be effective when compared to other remedial technologies in reducing the source area COC concentration. Though the groundwater collection trench principally addresses the West Ravine, it may be possible to design this additional in-situ measure at the former tank farm area to work in conjunction with the trench.

Long-term Reliability:
The tank farm remedy will be implemented over a period of months to years. It is anticipated to permanently reduce the concentration of COCs in this source area, and therefore will be reliable over the long term.

Constructability:
The in-situ technology is under development, but will be designed to easily integrate with the containment concept.

Implementation Risk:
The in-situ technology is under development, but will be designed to easily integrate with the containment concept.

7.4 Institutional Controls

Effectiveness:
EMD site safety program protocols to eliminate potential exposure of on-site workers to waste/impacted media have proven effective in the past and will continue to be effective. Deed restrictions that will run with the land are anticipated to be an effective control to prevent unprotected exposure to waste/impacted media as a result of subsurface excavations and will also govern the design of any future buildings to be constructed in the affected area of the site.

Long-term Reliability:
The EMD site safety program is reliable and updated regularly. After the installation, site operational practices may need to be modified with controls implemented to protect workers and subcontractors. The long term reliability of the program will be ensured by continued education of employees both on- and off-site. The deed restriction will be utilized should the property be transferred to a different owner. The restriction will be recorded in the Hamilton County Platt Book filed to remain with the property through all such transfers, and would be subject to local and state laws.

Constructability:
This evaluation criterion does not apply to the institutional control.

Implementation Risk:
Implementation risks associated with the institutional controls are low. On-site facility practices are self-directed; however, the filing of deed restrictions is subject to local and state laws.

Similar restrictions are filed in these circumstances, and the likelihood of the restriction's denial for this property does not seem likely.

7.5 Performance Monitoring

Effectiveness:
Groundwater monitoring is anticipated to be an effective means for assessing the performance of the remedy components. With concentrations of COCs already below risk based goals at the point of compliance, there is a large safety factor inherent in the performance monitoring. Any indication that hydraulic containment is not being attained will prompt chemical monitoring of groundwater from select monitor wells (collection and analyses of groundwater samples). Concentrations of COCs would be evaluated to determine if the potential for off-site migration of COCs above risk-based goals was occurring.

Hydraulic monitoring and effluent monitoring recommended on a quarterly basis for the first year, and then quarterly for four years after remedy installation with a review of the monitoring plan thereafter. The initial two year time period should allow any dissolved concentrations near the buried waste in the West Ravine to migrate to the point of compliance and to establish a baseline from which to compare performance.

Long-term Reliability:
The long-term reliability of performance monitoring is largely a function of the construction and maintenance of the groundwater monitoring wells. Monitoring wells will be inspected and replaced as needed. The potential replacement of groundwater monitoring wells is not a detriment of the proposed remedy.

Constructability:
The construction of groundwater monitoring wells is routine, though some additional consideration may be needed for the locations the wells are needed. On-site locations for the placement of wells are limited and previous permitting requests with ODOT have been denied. Flexibility in the placement of monitoring wells should be sufficient to address this concern.

Implementation Risk:
Monitoring wells have been installed and used at this site and the adjacent ODOT property for a long time. There is a relatively small risk incurred with installing additional wells.

8.0 Public Participation and Completion

8.1 Mechanisms for Public Participation

All applicable reports have historically been made available to the general public at the Cincinnati Public Library (Norwood Branch) located at 4325 Montgomery Road, Cincinnati, Ohio.

A public meeting was held by Ohio EPA following completion of the RI in 1996.

A notice for a public meeting will be placed into the local newspaper. If public interest warrants, a public meeting will be held to discuss the proposed corrective measures. Input from any public meeting and any formally submitted public comments will be considered by U.S.EPA as part of the remedy selection process and during preparation of the Statement of Basis.

8.2 Corrective Measures Implementation Order

Upon acceptance of the CMP the U.S.EPA will issue a Corrective Measures Implementation Order (CMI) to document the performance standards and requirements associated with implementation and operation of the chosen remedy.

The CMI Order will ensure that the long-term requirements for operation and maintenance of the chosen remedy, including any monitoring and institutional controls, are defined and adhered to until the corrective measures are deemed complete or no longer required.

9.0 References

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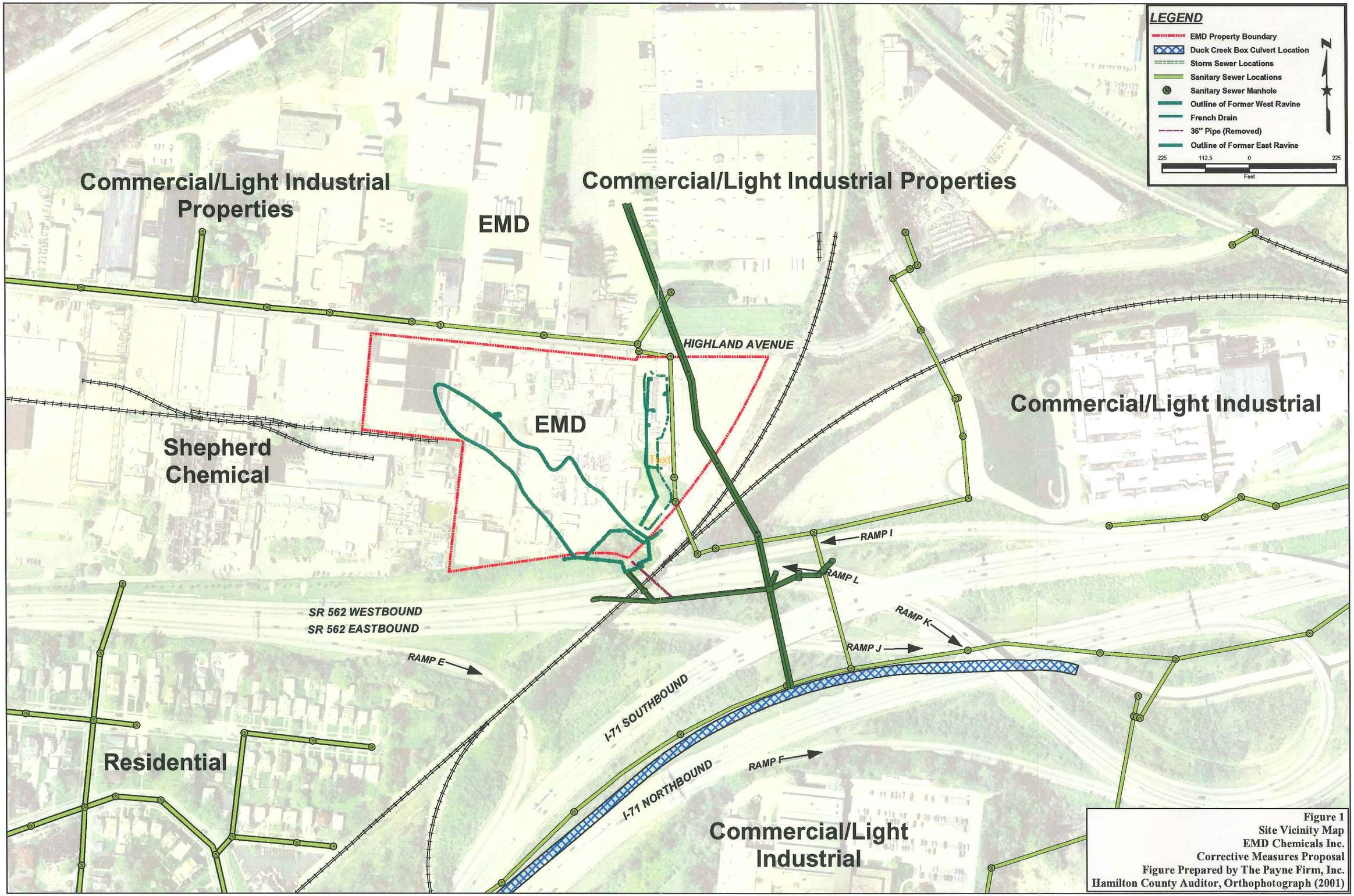

Figure 1
Site Vicinity Map
EMD Chemicals Inc.
Corrective Measures Proposal
Figure Prepared by The Payne Firm, Inc.
Hamilton County Auditor, Orthophotograph (2001)

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HIGHLAND AVENUE

SHIP SOUTH
Distribution

B 13
Office

B 23
Employee Welfare

B 16
Lab

Utilities
B 8

B 1
Office

Solvent Lab

B 19
Distillation & Filling

B 9 B 10
Repackaging

B 3
Maint.

B 11
Drum Filling

Existing French
Drain Area

PARKING

Existing P6A
Gradient Control
Well

Waste Water
Monitoring

New Water Collection
Treatment System

B 17
Dry Repackaging

DRUM STORAGE

B
14
Warehouse

B 4
Liquid
Repackaging

B 18
Warehouse

Existing
Sump

Railroad

ODOT Interstate

LEGEND

- West Ravine Outline
- Existing French Drain Area
- Existing P6A Gradient Control Well
- Existing Leachate Collection Sump
- Former Tank Farm Area

Figure 3
Facility Map
EMD Chemicals Inc.
Corrective Measures Proposal
Figure Prepared by The Payne Firm, Inc.

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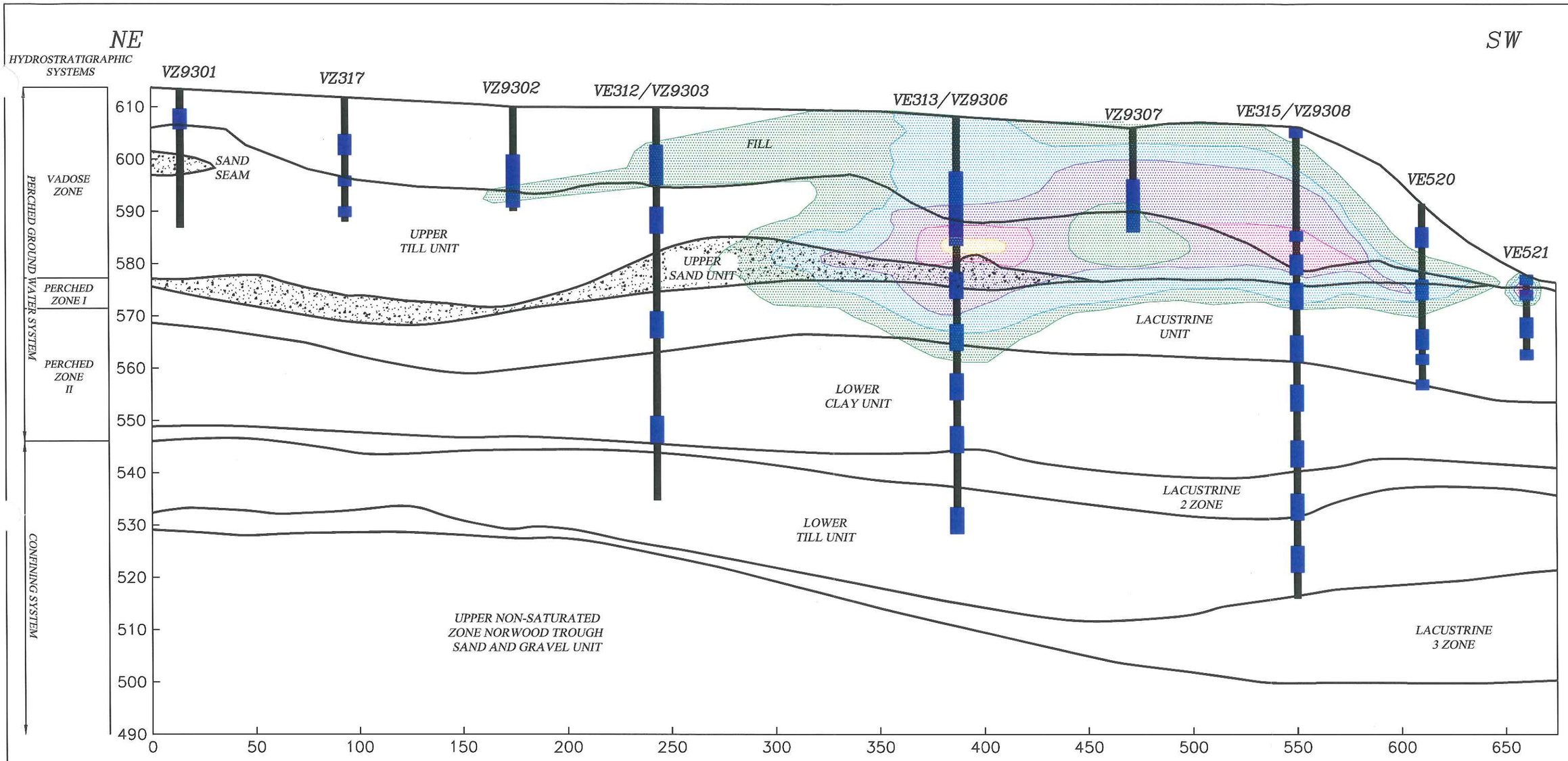
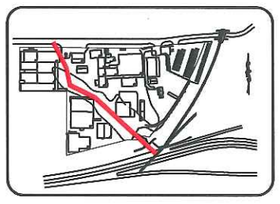


LEGEND

- 100-1,000 ug/kg TOTAL VOCs
- 1,000-10,000 ug/kg TOTAL VOCs
- 10,000-100,000 ug/kg TOTAL VOCs
- 100,000-1,000,000 ug/kg TOTAL VOCs
- 1,000,000-1,100,000 ug/kg TOTAL VOCs
- SAMPLED INTERVAL



0 25 50 75 100

HORIZONTAL SCALE: 1" = 50'

0 10 20 30 40

VERTICAL SCALE: 1" = 20'

Figure 4
Perched Groundwater Units
EMD Chemicals Inc.
Corrective Measures Proposal
Figure Prepared by The Payne Firm, Inc.

The Payne Firm, Inc.
Environmental Consultants
Cincinnati, Ohio 45242

DATE 04/02/96
APPROVED BY MRAV
FIGURE 4-17
DRAWN BY BDH
PROJECT NO. 100.50.10

CLIENT EMD CHEMICALS INC.

TITLE GENERALIZED CROSS SECTION SHOWING VERTICAL EXTENT OF VOC CONCENTRATION

SUBSURFACE CONVEYANCE PIPE (HDPE)

EXISTING CATCH BASIN

NEW CATCH BASIN

GROUNDWATER COLLECTION TRENCH

MAIN SUMP

TRENCH SUMP

RETAINING WALL

EXISTING CONCRETE WALL

REMOVE EXISTING CONCRETE SUMP AND ASSOCIATED PIPING

REFURBISHED HEADWALL

LEGEND

- EXISTING FENCE
- EXISTING PROPERTY LINE
- 605 PROPOSED TOPOGRAPHIC CONTOURS
- GROUNDWATER COLLECTION TRENCH
- RETAINING WALL

N

0 10 20 30

Scale In Feet

Figure 6
Groundwater Collection Trench Map
EMD Chemicals Inc.
Corrective Measures Proposal

CH2MHILL

FILE NAME: 1dn05c102_181174.dgn

NEW SURFACE COVER

BROUGHT TO GRADE

EXISTING GRADE WEST RAVINE

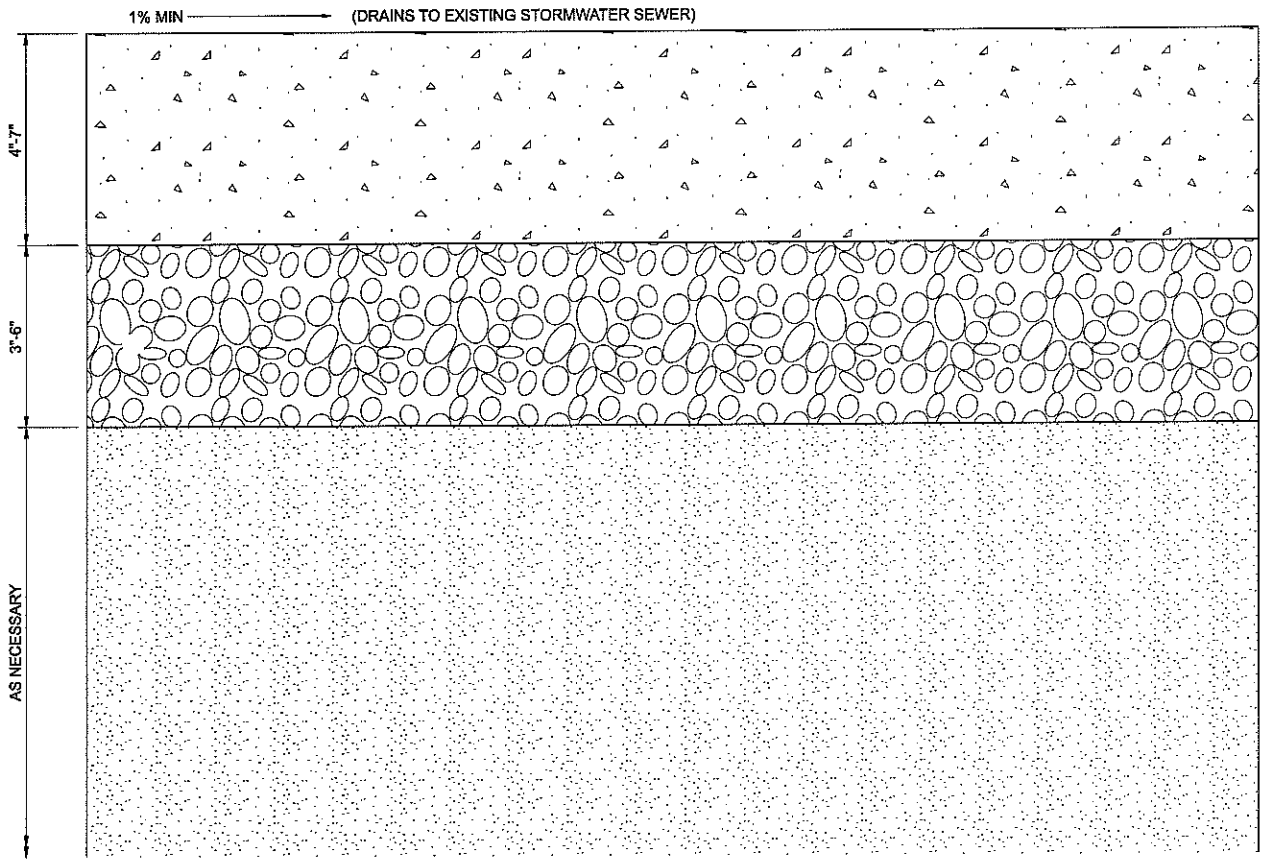
0 40' 80' 120'

GRAPHIC SCALE: 1" = 40'-0"

TITLE	FILL THICKNESS CONTOUR
DATE 6/17/05	SHEET 1
DRAWN BY MMH	APPROVED BY JAW
CLIENT	EMD CHEMICALS INC.
PROJECT NO.	100.58.26

The Payne Firm, Inc.
Environmental Consultants
Cincinnati, Ohio 45242

Figure 7
Proposed Areal Extent of New Surface Cover
EMD Chemicals Inc.
Corrective Measures Proposal



NOTE:
DRAWING IS NOT TO SCALE.

LEGEND

CEMENT CONCRETE

CRUSHED AGGREGATE BASE

COMPACTED RECONSOLIDATED SITE SOILS AND CLEAN FILL

SOURCE: ODOT PAVEMENT DESIGN & REHABILITATION MANUAL, APPENDIX C

05nf280f_181174.dgn

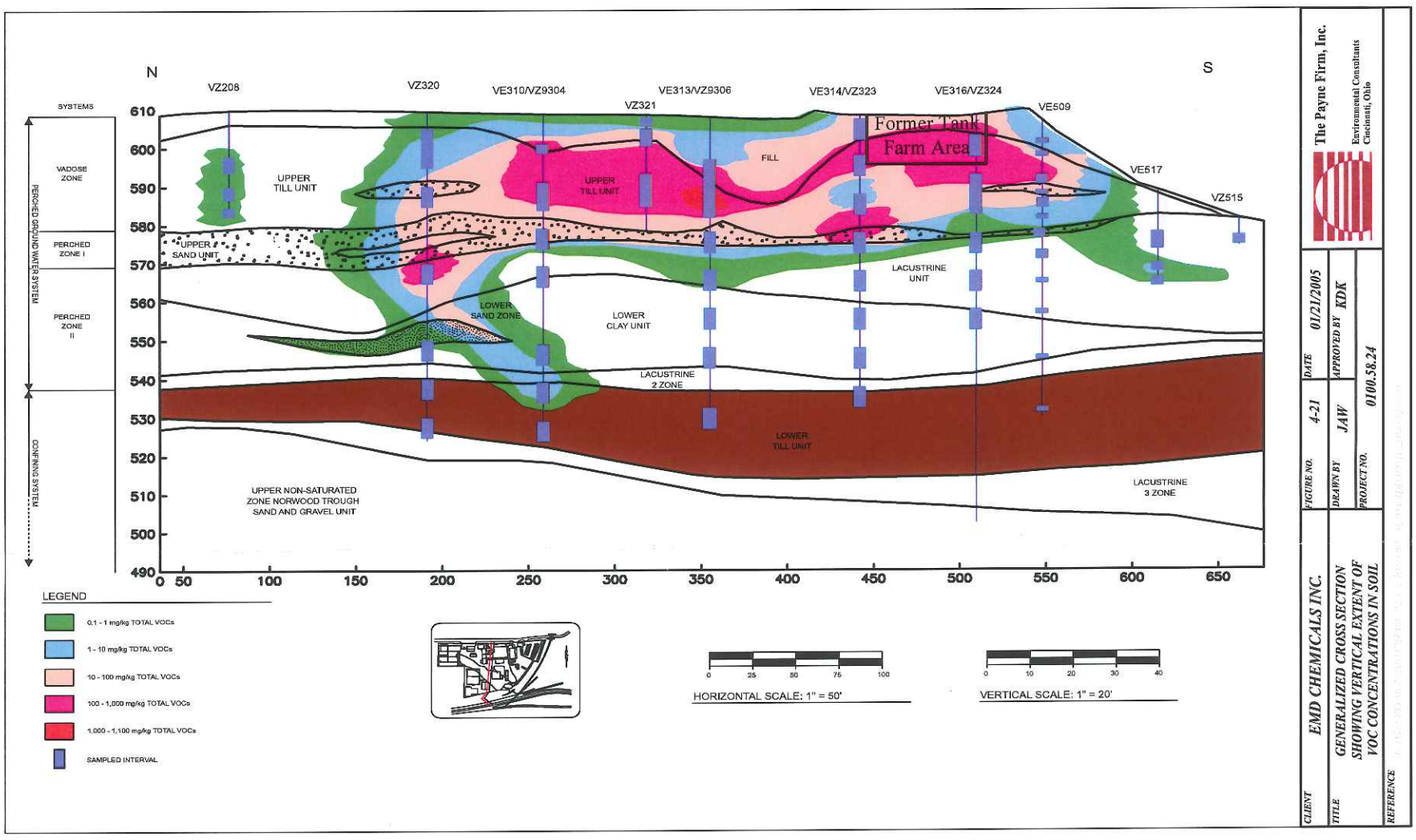
Figure 8
Conceptual Cross Sectional Schematic of
West Ravine Cover System
EMD Chemicals, Inc.
Corrective Measures Proposal

CH2MHILL

NOTE: FILL SAMPLES WERE COLLECTED BETWEEN ZERO AND FIVE FEET OUTSIDE THE LIMITS OF THE EAST AND WEST RAVINES. FILL SAMPLES WERE COLLECTED AT DEPTHS BETWEEN ZERO AND 26 FEET IN THE WEST RAVINE AND AT DEPTHS BETWEEN ZERO AND 48 FEET IN THE EAST RAVINE.

UNITS	CONTOUR INTERVAL (PPM)	DETECTED VOCS ONLY (PPM)											
		TOTAL VOCS		1,4-DIOXANE		MC, PCE, TCE		BTEX		CHLOROFORM		OTHER VOCS	
		TOTAL	%	TOTAL	%	TOTAL	%	TOTAL	%	TOTAL	%	TOTAL	%
FILL (A0, B0, B1)	0.1 - 1.0	4	100%	1	27%	0	1%	1	21%	0	1%	2.198	50%
	1.0 - 10.0	29	100%	10	34%	3	9%	3	12%	2	8%	11	37%
	10.0 - 100.0	249	100%	0	0%	77	31%	64	26%	20	8%	88	35%
	100.0 - 1,000.0	341	100%	0	0%	7	2%	304	89%	1	0%	29	8%
	1,000.0 - 10,000.0	4730	100%	0	0%	2040	43%	2390	51%	180	4%	120	3%

FILL – Total VOCs



North-South

Figure 9
Total VOC Concentrations in Former Tank Farm Area
EMD Chemicals, Inc.
Corrective Measures Proposal

Figure 4-8
Distribution of Constituents of Concern in Soil
Conceptual Model of Current Conditions
EMD Chemicals Inc., Cincinnati, OH
Figure Prepared by The Payne Firm, Inc.

Table 1

Summary Results for Constituents of Potential Concern Contributing the Majority of Risk for Potentially Complete Exposure Scenarios

EMD Chemicals Inc., Norwood, OH

Scenario	Media	Significant Chemicals[7]	Exposure Point Concentration[8]	Units	ELCR	Noncancer HI
On-Site Worker - Indoor Air	Soil[1]	1,1,2,2-Tetrachloroethane	1.87E+01	mg/kg	5.70E-06	NA
		1,2-Dichloroethane	2.32E+01	mg/kg	2.09E-05	0.5
		Benzene	1.86E+01	mg/kg	1.81E-05	0.2
		Chloroform	5.33E+01	mg/kg	1.30E-04	0.3
		Methylene Chloride	2.83E+01	mg/kg	1.23E-06	0.002
		Tetrachloroethene	3.69E+02	mg/kg	1.08E-04	0.1
		Trichloroethene	2.93E+01	mg/kg	5.93E-06	0.3
		Xylenes (Total)	1.25E+03	mg/kg	NA	0.2
	Groundwater[2]	1,2-Dichloroethane	9.69E+03	µg/L	1.23E-06	0.03
		Chloroform	3.13E+04	µg/L	1.40E-05	0.03
		Trichloroethene	3.13E+03	µg/L	2.51E-07	0.01
On-Site Construction Worker	Soil[3]	1,2-Dichloroethane	2.32E+01	mg/kg	6.47E-07	0.3
		Chloroform	5.33E+01	mg/kg	1.36E-06	0.1
		Tetrachloroethene	3.69E+02	mg/kg	2.08E-05	0.3
		Trichloroethene	2.93E+01	mg/kg	7.49E-08	0.1
		Xylenes (Total)	1.25E+03	mg/kg	NA	0.5
	Groundwater[4]	1,1,2,2-Tetrachloroethane	6.38E+02	µg/L	2.01E-06	0.01
		1,2-Dichloroethane	9.69E+03	µg/L	7.65E-06	0.3
		1,2-Dichloroethene (Total)	2.29E+03	µg/L	NA	0.3
		Benzene	1.13E+03	µg/L	1.78E-06	0.6
		Carbon Tetrachloride	2.86E+02	µg/L	NA	0.98
		Chloroform	3.13E+04	µg/L	1.56E-07	3
		cis 1,2-Dichloroethene	1.20E+03	µg/L	NA	0.1
		Methylene Chloride	1.14E+04	µg/L	6.17E-07	0.1
		Tetrachloroethene	3.42E+02	µg/L	1.28E-05	0.2
		Toluene	3.43E+03	µg/L	NA	0.2
		Trichloroethene	3.13E+03	µg/L	8.25E-07	0.9
		Vinyl Chloride	4.66E+02	µg/L	3.70E-06	0.1
		Xylenes (Total)	3.13E+03	µg/L	NA	0.1
Off-Site Construction Worker	Soil[5]	1,2-Dichloroethane	1.02E+02	mg/kg	2.85E-06	1.1[9]
		Carbon Tetrachloride	4.30E+00	mg/kg	1.43E-07	0.3
		Chloroform	1.61E+02	mg/kg	4.11E-06	0.4
		Trichloroethene	2.31E+01	mg/kg	5.92E-08	0.1
	Groundwater[6]	1,2-Dichloroethane	3.01E+02	µg/L	2.39E-07	0.01

Notes:

1 - CH2M HILL, 2006. Human Health Risk Assessment Addendum, EMD Chemicals Inc. Cincinnati, Ohio. (HHRA Addendum) Table 16

2 - HHRA Addendum Table 18

3 - HHRA Addendum Table 19

4 - HHRA Addendum Table 21

5 - CH2M HILL, 2006b. Human Health Risk Assessment Addendum of Off-Site Soils Technical Memorandum, EMD Chemicals Inc. Cincinnati, Ohio. Table 5

6 - HHRA Addendum Table 25

7 - Significant Chemicals were those with an HI above 0.1 or ELCR above 1×10^{-6}. Or HQ for 0.01 for Onsite Worker - Indoor Air, Groundwater and Off-site Construction Worker, Groundwater

8 - Exposure Point Concentration is the 95% Upper Confidence Level

9 - The non-cancer risk for 1,2-dichloroethane (0.0014 mg/kg-day) is a provisional value, based on a low-quality database, with very high uncertainty factors (http://risk.lsd.ornl.gov/tox/profiles/12dca.shtml#t32 "Risk Assessment Information System: Toxicity Summary for 1,2-Dichloroethane"). Note that the Agency for Toxic Substances and Disease Registry (ATSDR) more recently has estimated a chronic-duration Minimal Risk Level (MRL) of 0.7 mg/kg-day[1] (http://www.atsdr.cdc.gov/toxprofiles/tp38.html "Toxicological Profile for 1,2-Dichloroethane"). Therefore, it is likely that the Noncancer HI value presented in this table is overly conservative in evaluating potential risks from 1,2-dichloroethane.

NA = Not Applicable
ELCR = Estimated Lifetime Cancer Risk
HI = Hazard Index
mg/kg = milligrams per kilogram
µg/L = micrograms per liter

Table 2

Performance Monitoring Well Schedule

EMD Chemicals Inc., Norwood, OH

Monitoring Well Name	Geologic Unit Screened Interval
MW018	Sewer Backfill
MW023	Sewer Backfill
MW506	Sewer Backfill
MW504	Sewer Backfill
MW004	Fill
MW012	Fill
MW006	Fill
WRPZ05	Fill - Lower
MW509A	Fill - Lower
MW508	Fill - Lower
MW510A	Fill - Lower
MW021A	Upper Sand Unit
MW025A	Upper Sand Unit
MW029	Upper Sand Unit
MW031A	Upper Sand Unit
MW0326	Upper Sand Unit
MW035	Upper Sand Unit
MW014	Upper Sand Unit
MW016	Upper Sand Unit
MW011	Upper Till Sand Seams
MW025	Upper Till Sand Seams
MW021B	Upper Till Sand Seams
MW031B	Upper Till Sand Seams
MW002	Upper Till Sand Seams
MW001	Upper Till Sand Seams
MW051A	Upper Till Sand Seams
MW027	Upper Till Sand Seams
MW011A	Upper Sand Unit
P001	Upper Sand Unit
MW302	Upper Sand Unit
MW015	Upper Sand Unit
DPE02	Lacustrine Unit - Upper
MW008	Lacustrine Unit - Upper
WRPZ10	Lacustrine Unit - Middle
WRPZ15	Lacustrine Unit - Middle
MW505A	Lacustrine Unit - Middle
MW031C	Lacustrine Unit - Lower
MW041	Lacustrine Unit - Lower
WRPZ20	Lacustrine Unit - Lower
MW505B	Lacustrine Unit - Lower
MW507	Lacustrine Unit - Lower
MW011C	Lower Clay Unit - Upper
MW031D	Lower Clay Unit - Upper
MW017	Lower Clay Unit - Upper
MW015B	Lower Clay Unit - Upper

Table 2

Performance Monitoring Well Schedule

EMD Chemicals Inc., Norwood, OH

Monitoring Well Name	Geologic Unit Screened Interval
MW024	Lower Clay Unit - Upper
MW030	Lower Clay Unit - Middle
P006	Lower Clay Unit - Middle
MW042	Lower Clay Unit - Middle
MW026A	Lower Clay Unit - Middle
DW001	Lower Clay Unit - Middle
DW002	Lower Clay Unit - Middle
DW003	Lower Clay Unit - Middle
MW044	Lower Clay Unit - Middle
DW004	Lower Clay Unit - Middle
MW507B	Lower Clay Unit - Lower
MW509B	Lower Clay Unit - Lower
MW508B	Lower Clay Unit - Lower
MW510B	Lower Clay Unit - Lower
MW043A	Lacustrine 2 Zone
MW009	Fill
MW001A	Upper Till Sand Seams
MW005	Upper Till Sand Seams
MW013	Upper Till Sand Seams
MW014A	Upper Till Sand Seams
MW301	Upper Till Sand Seams
MW501	Upper Sand Unit
P005	Upper Sand Unit
P006A	Lower Clay Unit - Middle
P007	Lower Clay Unit - Middle
P008	Lower Clay Unit - Middle
P009	Lower Clay Unit - Middle

Response to U.S.EPA Comments on EMD Chemicals Inc.

Draft Correct Measures Proposal

These are the final U.S.EPA comments on the EMD Chemicals Inc. (EMD) Draft Corrective Measures Proposal (Draft CMP) received by Mark Altic, CH2M HILL Project Manager from Mr. Don Heller, U.S.EPA, Region 5 Project Manager as follows:

July 6, 2006 – via telephone conversation

July 14, 2006 – via telephone conversation

July 26, 2006 – via telephone conversation

August 24, 2006 – via e-mail

Draft responses for comments received in July were submitted to USEPA on August 8, 2006. Responses were accepted by USEPA with additional comment provided in the August 24th e-mail correspondence. EMD's responses are included below each comment.

Comment 1: *Revise Figure 3 to show the location of the former tank farm area. Emphasize in text that most of it lies over the West Ravine.*

Response – The figure will be revised to show the location of the former tank farm area and a discussion added to the text. However, the majority of the former tank farm does not lie over the West Ravine, it is to the west. The proposed location of the trench is designed to capture downgradient migration from the former tank farm location.

Comment 2: *U.S.EPA would like a schematic showing former tank farm concentrations vs depth. Discuss treatment with in-situ approach.*

Response – EMD believes that the information requested is a bit too detailed for the scope of the CMP. EMD proposes to reference the report(s) where the information can be located in the CMP.

The approach to treatment with an in-situ remedy is discussed in brief in the current Draft CMP. The design details still need to be worked out. Since the tank basin remediation project is not a necessary component of the CMP and is additional work EMD elected to perform, EMD proposes to keep the discussion of the tank basin remediation as is. EMD will provide details of the tank basin remedial design to the U.S.EPA when the plan has been further developed.

An additional comment on this response received from Don Heller via e-mail communication on August 24, 2006 follows: *Include in the text a brief description of the contamination and its depth beneath the former tank farm.*

Both the initial comment and the additional comment are addressed in Section 6.2.5 of the revised CMP.

Comment 3: *The U.S.EPA wants more details on performance monitoring – specify in a table what wells are to be sampled and what frequency, and type and frequency of visual inspections for cover system.*

Response – A table showing the following will be added to the Draft CMP:

- well to be monitored including frequency and type of monitoring; and,
- type and frequency of visual inspections to be performed on the remediation system and cover system.

Please note that the performance monitoring plan presented in Section 6.4.1 and Section 7.5 of the Draft CMP calls for monitoring of the potentiometric surface to determine if hydraulic containment is being achieved. If it is determined that hydraulic containment is not being attained, then chemical monitoring would be instituted.

An additional comment received via telephone conversation on July 26, 2006 between Don Heller and Mark Altic follows.

Comment: Please include a delineation of the proposed cover system over the West Ravine including aerial extent and a generalized cross-sectional schematic showing proposed construction details. Also, include an O&M inspection plan for this cover system.

Additionally, the following comment was received from Don Heller via e-mail communication on August 24, 2006: *Also, as we discussed, include a general description and areal diagram of the existing and proposed impermeable cover over the West Ravine SWMU.*

Response – Proposed construction details are included in Section 6.2.1.3. Proposed O&M inspection type and frequency is included in Section 6.4.1.

The following description of the existing cover system is provided in lieu of multiple figures depicting generalized construction that would be speculative in nature due to the construction history of this facility:

> The currently existing cover system consists of asphalt or concrete on top of a compacted sub-base in most areas of the site with a small area on the southern portion of the West Ravine consisting of gravel only. In the mouth of the West Ravine, the cover system consists of vegetation on top of soil and demolition debris.